

## Wounding Effects of the AK-47 Rifle Used by Patrick Purdy in the Stockton, California, Schoolyard Shooting of January 17, 1989

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The limited disruption produced in tissue simulant by the rifle and bullets used in the Stockton, California, schoolyard shooting is entirely consistent with the autopsy reports on the five children who died of their wounds. It is also entirely consistent with well-documented battle-field studies and with previous tissue-simulant studies from many laboratories. It is inconsistent with many exaggerated accounts of assault-rifle wounding effects described by the media in the aftermath of this incident. This information should be documented for the historical record. However, the critical reason for correcting the misconceptions produced by media reaction to this incident is to prevent inappropriate gunshot-wound treatment.

**Key Words:** AK-47 rifle—Wound ballistics—Military rifle bullets—Assault rifle—Ballistic injury—Wound treatment.

On January 17, 1989, Patrick Purdy used a semiautomatic AK-47 Chinese military-type rifle (Norinco, serial no. MS010963) to fire 104 shots into a schoolyard filled with children in Stockton, California, U.S.A. All of the bullets that Purdy fired were 124-grain full-metal-jacketed military type loaded in 7.62 × 39-mm cartridges made by the Federal Cartridge Company of Anoka, Minnesota (documented in the Stockton Criminalistics Laboratory by identification of the empty cartridge cases recovered from the crime scene). Thirty-five of those in the schoolyard were injured by Purdy's bullets. Of the 35 wounded, 30 were treated in eight hospitals and survived their wounds. Five died in the schoolyard.

The media seized on the Stockton incident with sensationalistic zeal. Distortions, exaggerations, and uninformed assumptions were presented as fact. Subsequent corrections of factual errors were, in most cases, ignored. The public and medical personnel called upon to treat shooting victims have consequently been deprived of the established facts about the true effects of assault rifles. These failings have made this report necessary. To be dealt with appropriately, the gunshot-wound problem must be approached with verified facts and competently collected data.

### METHODS

Eight shots were fired from a distance of 3 m into 25 × 25 × 50-cm blocks of 10% ordnance gelatin placed end to end at 4°C gelatin temperature. This gelatin has been shown to reproduce the projectile deformation and penetration depth seen in living animal muscle (1). A sufficient number of gelatin blocks were placed end to end to capture the entire projectile path. The rifle was fired from a fixed rest.

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**TABLE 1.** Bullet penetration and yaw in tissue simulant

Shot no.	Make/type	Velocity (m/s)	Penetration (cm)	Yaw begins (cm)
1	Fed FMJ	678	72	10
2	Fed FMJ	671	78.5	17
3	Fed FMJ	672	74	10
4	Fed FMJ	681	77.5	17.5
5	Fed FMJ	678	66+	14
6	WW SP	692	35	NA
7	WW FMJ	678	72	12
8	Norinco FMJ	716	76	20

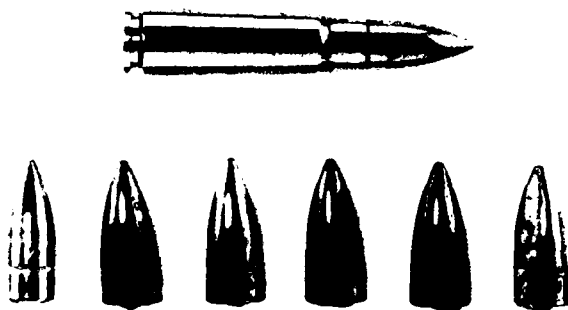
Make: FED, federal; and WW, Winchester-Western. Type: FMJ, full-metal jacket; and SP, soft point.

Five shots were fired using the Federal 124-grain full-metal-jacketed ammunition found in Purdy's possession. This was identical to the ammunition fired in the Stockton schoolyard. One shot each was also fired using a Winchester-Western full-metal-jacketed bullet, a full-metal-jacketed bullet of Chinese manufacture (Norinco), and a Winchester-Western 123-grain soft-point bullet. All of these bullet types were found in Purdy's possession. Velocity was recorded and tissue disruption measured as described in the wound profile methodology (1).

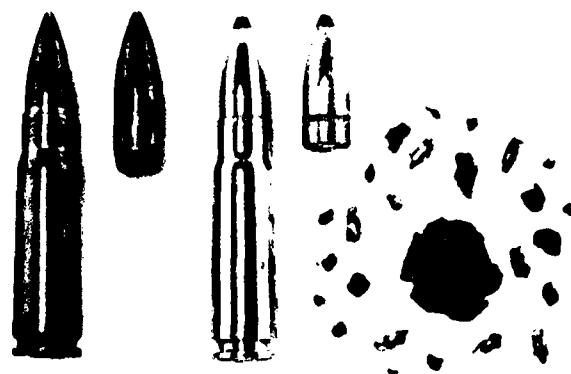
Autopsy reports on the five children who died of their wounds were reviewed, and hospitals where the survivors were treated were contacted for follow-up information.

## RESULTS

Numerical results of the shots are listed in Table 1. Figure 1 shows the five Federal full-metal-jacketed bullets recovered from the gelatin blocks. The last bullet on the right, listed as number 5 in Table



**FIG. 1.** Bullets loaded in Purdy's AK-47 clip. (Top) The unfired 7.62 × 39-mm (AK-47) cartridge with full-metal-jacketed bullet. (Far left, bottom) Unfired bullet. Compare with the fired bullets (recovered from gelatin tissue simulant) at the right. Note the flattening of the fired bullets. The bullet on the far right exited the gelatin and struck the range wall.



**FIG. 2.** Bullet-cartridge set (left): 7.62 × 39-mm (AK-47) Chinese (Norinco) full-metal-jacketed, steel-core bullet. Bullet-cartridge set (center): 7.62 × 39-mm soft-point hunting cartridge, Winchester-Western, lead-core unfired bullet. Fired soft-point bullet (right): bullet and fragments recovered from gelatin.

1, passed out the side of the gelatin block (at 66-cm penetration depth) and struck the wall of the shooting range. These Federal bullets have a copper jacket and a lead core; they all deformed slightly in the gelatin (bases flattened to  $\sim 5 \times 9.5$  mm; see Fig. 1). The bases of these Federal full-metal-jacketed bullets were unusual; they had a conical depression  $\sim 4$  mm deep in the lead core. A similar depression has been seen in only one bullet previously shot in our laboratory—the 7.62 × 54 R, used in Russian and Chinese light machine guns and sniper rifles. The Winchester-Western full-metal-jacketed bullet (no. 7, Table 1) performed identically to the Federal bullets. The Norinco full-metal-jacketed bullet did not deform at all, as expected, because its mostly steel core is much more resistant to compression than is lead, as shown second from the left in Fig. 2.

The maximum temporary cavity diameters estimated from the radial cracks in the gelatin (1) were all 14–16 cm in diameter, and their location was at a penetration depth of 6–12 cm deeper than the location where bullet yaw began (see Fig. 3).

Deformation of the Winchester-Western soft-point bullet included a flattened tip, a diameter expanded to  $15 \times 16.5$  mm, and a 22% loss of weight through fragmentation (see bottom right, Fig. 2); its temporary cavity began after only a few centimeters of penetration, where the bullet had expanded.

## Summary of Autopsy Findings

(a) In each child, the bullet passed through a vital structure: the head in one case, the heart in one, the

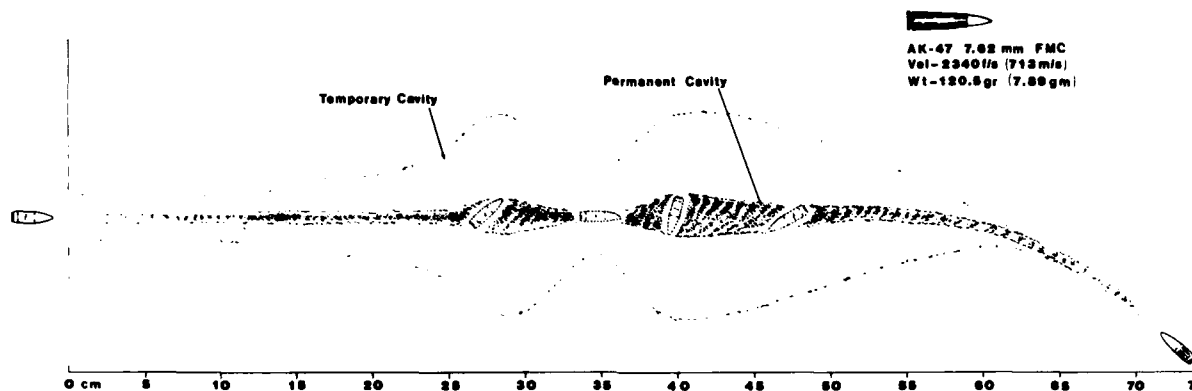


FIG. 3. Wound profile of the military AK-47 bullet shows the typical long distance of penetration (25 cm) before significant bullet yaw begins. This explains the clinical experience that many wounds from this weapon resemble those caused by much lower-velocity handgun bullets.

liver in one, the lungs in one, and the aorta and spinal cord in one.

(b) On two occasions, a second shot was reported to have passed through a hand and, in one case, through a foot. In one of the hand perforations, it is unequivocal that a second shot, rather than the same shot, had perforated two body parts: the bullet had passed through the sternum, the heart, and then through a vertebral body, and was found just under the skin of the back. This was the only bullet retained in the body on any of the autopsies.

(c) The weights of the children were 20, 18, 26, 19, and 25 kg.

(d) The largest tissue disruption in any of the organs was ~3.81 cm, in the right lobe of the liver.

(e) There was no damage to any organ not hit directly by a bullet.

### DISCUSSION

The action of all of the full-metal-jacketed bullets followed the basic pattern described previously (2) and shown in the wound profile (Fig. 3). The Federal full-metal-jacketed bullets used by Purdy are of flat base design and shorter than the military rounds (compare Figs. 1 and 2). Their mean penetration distance before significant yaw (13.7 cm) is considerably shorter than that of the AK-47 military round as shown on the wound profile (25 cm) and that seen in shot no. 7 (20 cm).

That 86% of the wounded survived is not surprising to those who are familiar with the relatively mild wounding characteristics of the AK-47 military round (3). The Russian/Chinese military full-metal-jacketed AK-47 bullets, with steel cores, do not deform on striking the body, unless they hit bone.

These AK-47 bullets characteristically travel point-forward until they penetrate 25 cm of tissue. Only when this type of bullet yaws, turning sideways during its path, does it cause significantly increased disruption (Fig. 3). Therefore, many AK-47 shots will pass through the body, causing no greater damage than that produced by nonexpanding handgun bullets. The limited tissue disruption produced by this weapon in the Stockton schoolyard is consistent with well-documented data from Vietnam (the Wound Data and Munitions Effectiveness Team collected ~700 cases of AK-47 hits), as well as with controlled research studies from wound ballistics laboratories (2-4).

Our study shows that the Federal full-metal-jacketed bullets used by Purdy yaw (increase the angle between the bullet long axis and the bullet path) at a shallower penetration depth than the standard Russian/Chinese military ammunition. Ordinarily, this action should make these bullets more disruptive. However, the children shot were small (18-26 kg), obviously increasing the chances for a bullet to pass through the body before yawing to a significant degree, and undoubtedly contributing to the high survival rate. The slight flattening seen in the lead-core Federal bullets does not significantly increase the wound size. The magnitude of the tissue disruption reported from the fatal wounds inflicted by the AK-47 bullets fired by Purdy was, in fact, no greater than that produced by many common handgun bullets.

Much of the media coverage generated by the Stockton shooting has contained misstatements and exaggerations. The myth of "shock waves" resounding from these "high velocity" bullets "pulverizing bones and exploding organs" (even if they were not hit by the bullet) "like a bomb" going off in

the body was repeated by the media, in certain cases even *after* they were furnished solid evidence that disproved these absurdities (5). None of the autopsies showed damage beyond the projectile path. One "expert" was quoted as stating that the death rate from "assault weapons . . . approaches 50 percent" (6). Another, reporting on the effects of "high speed" bullets, stated that "most of those hit in an extremity will end up with amputations. If you're hit in the trunk, it becomes a lethal injury. . ." (7) In the Stockton schoolyard, the death rate was 14% and none of the victims died later or required extremity amputation. Extensive war-wound experience (Wound Data and Munitions Effectiveness Team information on 1,400 cases of rifle wounds from the Vietnam conflict) and laboratory studies with the AK-47 are consistent with the Stockton injuries (2-4). The first author of this report has treated many nonlethal trunk wounds from a variety of assault rifles. In his experience, extremity wounds from these weapons requiring amputation are extremely rare. The assault rifle fires a bullet that is intermediate in power between the bullets of regular infantry rifles and handguns. Trunk wounds are lethal when this bullet hits vital structures, as is supported by the autopsy findings from Stockton.

Pertinent to the material reviewed for this report, the Chief of Police of San Jose, Joseph D. McNamara, stated that "one bullet hitting a child in Stockton, took out his entire stomach." (8) Our review of the autopsy reports shows that only one of the children killed by Purdy in the Stockton schoolyard had stomach damage. The report states, "STOMACH: There is a perforating wound of the antrum due to passage of the bullet. The stomach is otherwise normal. There is no spillage of gastric contents." An unsuspecting public and medical community might accept Chief McNamara's highly exaggerated description as fact.

The exaggerated description of assault-rifle effects by the media has had the pernicious effect of causing an unprecedented demand for assault rifles. Estimates from sales figures indicate that the number of these weapons in California greatly increased after the Stockton shooting.

Overstated assault-rifle effects could also prejudice inexperienced surgeons toward the already widespread fallacy that great amounts of tissue must be excised when treating wounds made by projectiles assumed to be of high velocity (3,9), possibly making the treatment worse than the wound.

We suggest that the media preference for dramatic exaggerations and quoting unqualified pseudoexperts, has done a great public disservice.

Mercy and Houk, in their editorial "Firearms injury: a call for science" (10), make a strong plea for "the application of sound scientific principles . . . to acquire the information needed to identify successful strategies to prevent firearm injuries."

Our work of the past 8 years has centered around identifying and correcting misconceptions that have permeated the field of ballistic injury, and our findings strongly support Mercy and Houk's appeal for sound science (11,12). As a caution to those who would collect data on shootings, some potential sources of error inherent in this field must be delineated:

(a) Many shootings result in legal action. Falsification of the circumstances surrounding the incident (range of fire, type of weapon, intermediate targets, and so forth), intentionally or through ignorance, is common. A good appreciation of the wounding characteristics produced by common firearms is mandatory to recognize inconsistencies. Verification of the weapon, bullet type, and circumstances is necessary to separate fact from rumor.

(b) Firearm nomenclature is irrational and confusing. For example, a 30-30, a 303 British, a 300 Savage, a 30-06, a 308, a .30 Carbine, a 7.62 NATO, a 30-40 Krag, and several magnums, all shoot a 30-caliber bullet [of 7.62-mm (0.308-inch) diameter]. These bullets are of varying weights and types, each producing a characteristic, but *distinctly different*, damage profile in the body. Unless the investigators are extremely competent in firearm technology, a Firearms Examiner from the local Criminalistics Laboratory should be a member of any research team expecting to gather valid data.

(c) Distortion of scientific method, oftentimes to substantiate emotional arguments or to increase publicity and political action, poses an especially serious threat in the field of gunshot injury. Shooting watermelons for television demonstration and then claiming identical effects in the human body is a good example of such distortion. The human body certainly possesses a great deal more elasticity and resiliency than a watermelon.

These formidable barriers to the accurate study of firearm injuries must be clearly recognized and properly managed to obtain valid data.

## CONCLUSIONS

Gunshot wounds pose a serious problem. Any sensible solution demands sober consideration of valid data on wound frequency, severity, circumstances, and treatment. Considering the thousands of shootings in our urban areas each year, a nation-

ally based program of *competent* and scientifically sound data collection could define the problem realistically and objectively. Only by using verified facts can a responsible plan of action, unfettered by emotionalism and misinformation, be formulated. A clear understanding of bullet effects is mandatory for valid research in ballistic injury and rational treatment of gunshot wounds. □

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