CASE REPORT

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Fatal .45-70 Rifle Wounding of a Policeman Wearing a Bulletproof Vest

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ABSTRACT: This report presents the findings in the case of a fatal gunshot wound from a relatively high-energy rifle suffered by a law enforcement officer wearing a bulletproof vest. Also presented is a discussion of missile energy transfer for individuals wearing protective clothing.

KEYWORDS: criminalistics, protective clothing, wound ballistics

A 25-year-old policeman who stopped an apparent traffic offender was shot in the right upper anterior thorax by a .45-70 rifle from a distance of approximately 3 to 4.5 m (10 to 15 ft). The officer was wearing a Model Y Second Chance Body Armor vest. The bullet first struck and shattered a metal nameplate just above the officer's right front shirt pocket. It then penetrated the protective vest, forming a cone-shaped wad of compressed vest layers that were driven ahead of the bullet and penetrated the officer's chest, perforating the upper lobe of the right lung (see Figs. 1 and 2). Although the bullet did not pass through the vest, the kinetic energy of the missile created a 4.1- by 3.9-cm perforation in the chest wall, circumscribed by rather severe clothing abrasions about the margins of the wound caused by the vest (see Fig. 3). This cone-shaped formation in the vest (see Fig. 4) penetrated the chest between the right second and third ribs, fracturing the second rib. In the pleura of the upper lobe of the right lung a 3.0- by 2.5-cm defect was found. The shock wave created by the missile lacerated the aorta, the pulmonary artery, and the superior vena cava immediately adjacent to the heart, resulting in death by insanguination into the thoracic cavities.

Gray powdery material around the perforation in the shirt and within the penetration of the vest was demonstrated in the laboratory to be lead spray resulting from the bullet striking the nameplate. The inner surface of the protective vest was intact, with the exception of a small tear along one side of the cone-shaped formation. A markedly deformed bullet was removed from the depths of the cone in the vest.

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FIG. 1—*Schematic drawing of the site where the .45/70 missile struck the officer's protective vest.*

FIG. 2—*Schematic drawing illustrating the cone-shaped deformation of the vest produced by a high-energy missile. Insert depicts the approximate site and size in proportion to the chest wall.*

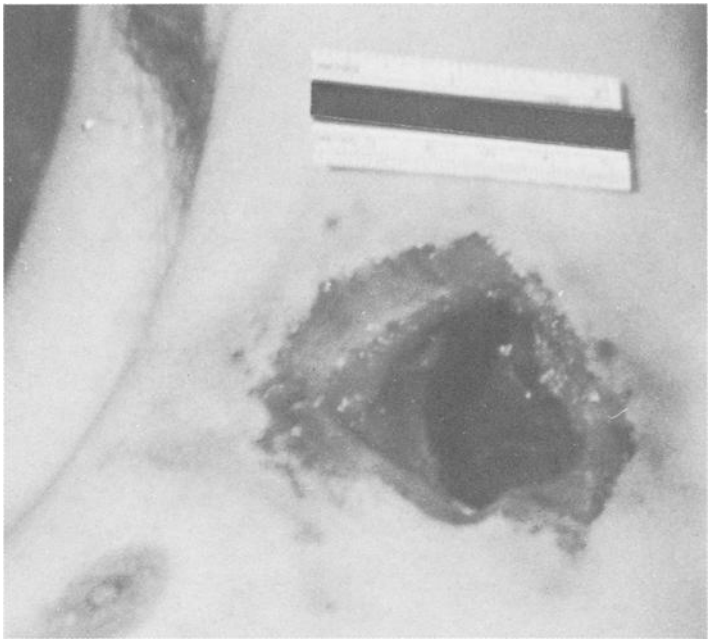

FIG. 3—*Close-up photograph of the perforation in the right anterior chest wall. Note the severe abrasions around the margins of the wound caused by the vest.*

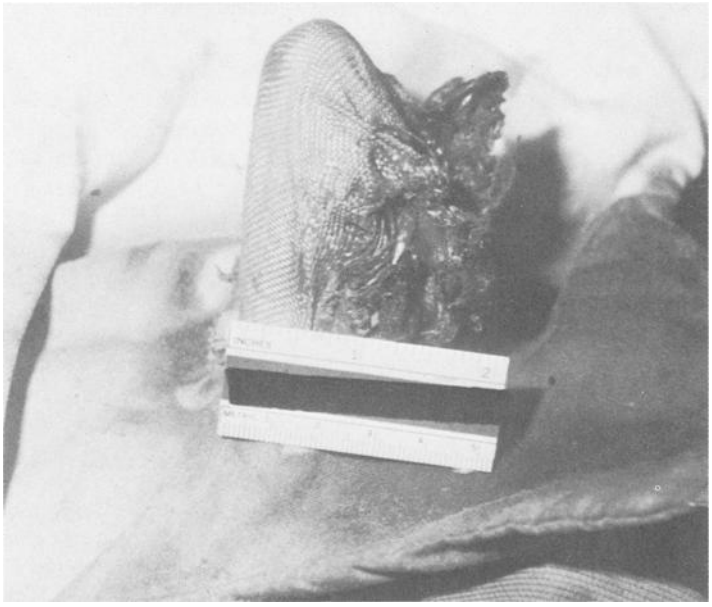

FIG. 4—*The cone-shaped deformation of the vest.*

Discussion

Many types of bullet-protective or bulletproof vests are available; these vary from those that weigh a few pounds to those that are much heavier and include metal inserts. The heavier vests with metal inserts (hard body armor) are capable of protecting the wearer from high-energy military-type weapons, such as the M-16 and AK-47, while the lighter vests (soft body armor) are capable of protecting the wearer from most types of handguns. Soft body armor vests are commonly worn by law enforcement officers because they are inconspicuous and offer flexibility, comfort, and protection against most weapons these officers would customarily encounter. Hard body armor tends to be too inflexible, conspicuous, and uncomfortable for routine use. The vest worn in the incident described in this case report was a Model Y vest manufactured by Second Chance Body Armor (Clear Lake, MI). This vest, which is representative of the soft body armor commonly worn by law enforcement officers, weighs 1.1 kg (2½ lb) and is composed of 18 layers of Kevlar Aramid®, a polyamide fiber. This particular vest is designed to offer protection against weapons with muzzle energies up to approximately 1.7 kJ (1250 ft · lbf). This would include most .44 Magnum handguns. The vest is also capable of preventing penetration by most knives.

A protective vest essentially functions by dissipating the kinetic energy of the missile. Portions of this energy are expended in local deformation of the vest at the site of impact against the vest layers, while the remainder is consumed in the production of bullet deformation and heat. The kinetic energy K of the missile is defined by the formula:

$$K = \tfrac{1}{2}(MV^2)$$

where M = mass and V = velocity. In order to calculate the kinetic energy of a given missile in foot-pounds (joules) it is necessary to know the mass of the missile in grains (grams) and the velocity in feet per second (metres per second). These data can then be entered into the formula given above.

$$K\ (\text{ft} \cdot \text{lbf}) = \frac{(\text{velocity in ft/s})^2}{450{,}240} \times \text{mass (grains)}$$

The denominator incorporates the conversion factors into the formula.

Two .38 caliber gunshots to the abdomen of another officer wearing a Model Y vest resulted only in nonincapacitating superficial contusions (see Fig. 5). The energy of a .38 caliber missile varies depending upon the ammunition, ranging from the 390 J (289 ft · lbf) of a 158-grain bullet with a velocity of 278 m/s (910 ft/s) to 713 J (528 ft · lbf) of energy for a .38 Special using a 125-grain bullet with a velocity of 421 m/s (1380 ft/s). A newspaper report of an officer shot in the chest by his own .357 Magnum revolver while wearing a vest of the Model Y type described the resultant injury as a "deep bruise" that was nonincapacitating. This injury might be presumed to be an abrasion with surrounding contusion. The approximate muzzle energy of a .357 Magnum is 1.1 kJ (826 ft · lbf) with a 158-grain bullet at a velocity of 468 m/s (1535 ft/s). Numerous reports of individuals wearing the Model Y vest and shot by weapons such as .38 caliber handguns and .357 Magnums describe similar nonincapacitating superficial injuries. Impact by .22 caliber weapons results in areas of "soreness" or only minor contusion.

The .45/70 designation of the rifle used in this case denotes the use of a .45 caliber bullet and, in the old nomenclature, 70 grains of black powder. A 300-grain bullet with a velocity of 552 m/s (1810 ft/s) was used. Since the range of this gunshot was only 3 to 4.5 m (10 to 15 ft), the energy at impact was essentially that at the muzzle. The muzzle energy of this bullet (2.9 kJ [2183 ft · lbf]) was well above the approximately 1.7 kJ (1250 ft · lbf) the vest was designed to stop. In addition to the energy expended in deforming the vest, some of the

FIG. 5—*Superficial contusions caused by two .38 caliber gunshots to the abdomen of an officer wearing soft body armor (courtesy of Second Chance Body Armor, Inc.).*

bullet's energy was spent in shattering the metal nameplate and in fracturing the rib. The remaining energy was not enough to perforate the vest. According to manufacturer's tests, the Model Y vest is customarily perforated by relatively high-energy weapons such as the .30-06 rifle.

One might ask whether or not this officer could have survived if the bullet had perforated the vest and chest wall and exited the body, so that there was incomplete transformation of the missile energy into work in the body. Under such circumstances, the resulting shock wave may not have been of a magnitude that would produce the fatal lacerations of the mediastinal great vessels.

This case presentation is not designed to cast doubt on the usefulness of soft body armor such as the protective vest worn in this incident. The majority of police killings involve handguns, for which protective vests of the Model Y type worn by this officer are more than sufficient protection. The hard body armor needed for protection against a high-energy weapon probably would not be worn because it is uncomfortable, impractical, and conspicuous. The failure of the rifle to perforate the vest in this unusual case was probably due to the expenditure of energy in shattering the nameplate and fracturing the underlying rib. Since the bullet was stopped in the vest in approximately 7.6 cm (3 in.), there was a rapid and complete transformation of all the kinetic energy of the bullet into work. Some of this work was expended in shattering the nameplate, deforming the bullet and vest, and producing heat. The remainder was expended in perforating the chest wall and creating a shock wave that produced fatal lacerations of the mediastinal great vessels. The resulting injuries may have been more severe than if this missile had perforated the vest.

Acknowledgments

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