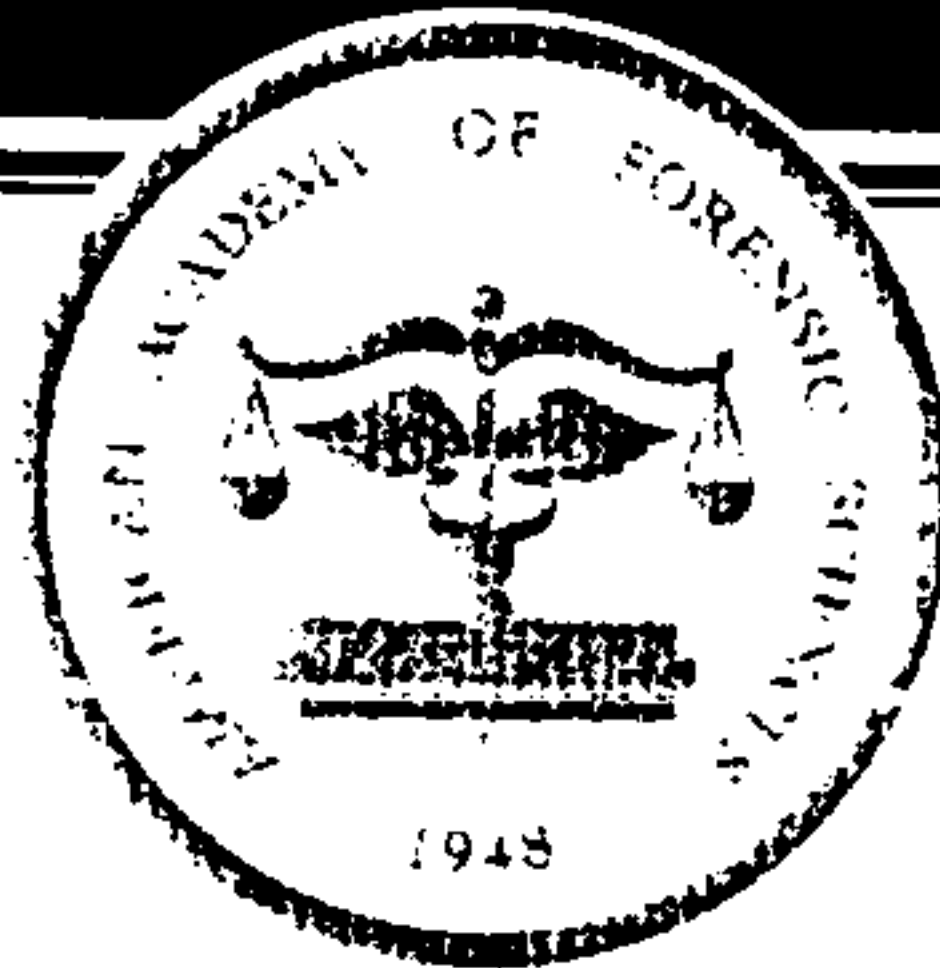


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Effects of the Taser in Fatalities Involving Police Confrontation

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ABSTRACT: Sixteen deaths associated with the use of the Taser were examined. All involved young males who had a history of abuse of controlled substances; all but three were under the influence of cocaine, phencyclidine [phenylcyclohexylpiperidine (PCP)], or amphetamine. All were behaving in a bizarre or unusual fashion which necessitated calling the police. The cause of death was an overdose of drugs in eleven, gunshot wounds in three, heart disease and Taser shock in one, and an undetermined cause in one. All were considered to be under the influence of PCP by the police at the time of the incident. All were unarmed, which was the reason a Taser was used instead of a more lethal weapon. The conclusion reached after evaluation of these cases is that the Taser in and of itself does not cause death, although it may have contributed to death in one case.

KEYWORDS: criminalistics, Taser, death, controlled substances

In the search for less lethal means of subduing violent and uncooperative suspects, police departments have experimented with a variety of weapons. Among these is the Taser gun. The Taser (Tom A. Swift Electric Rifle) is a small, hand-held electrical device about the size of an ordinary flashlight which fires two barbs into the subject and delivers an electrical charge. The charge is designed to shock and immobilize the subject but not to inflict serious injury or cause death. It was originally designed for use by airline personnel to thwart hijackings but has passed into use by law enforcement agencies as an alternative to the upper-body restraint holds more commonly known as choke holds.

The Los Angeles Police Commission, which banned the use of choke holds, approved the use of the Taser in May 1982. Since then it has been used several thousand times by the Los Angeles Police Department (LAPD) in attempts to control violent suspects. It has also been used by the Los Angeles Sheriff's Office and other police agencies in the county. During that time there have been 16 deaths associated with the use of the Taser in Los Angeles County. This report is an analysis of these deaths.

Less Lethal Weapons

The purpose of a less lethal weapon is to subdue a violent, hostile, or uncooperative suspect and effect his or her arrest without causing harm to the suspect, the arresting

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officers, or innocent bystanders. The weapon should be designed to overcome resistance quickly and make the use of more lethal weapons, such as the baton or gun, unnecessary.

To be effective, the weapon must be capable of use at short range, it must be immediately available to the officer, and it must be designed for use with one hand. The weapon must produce an instantaneous effect and must temporarily disable the suspect so that an arrest can be made without injury. In addition, the weapon must be effective against individuals who are under the influence of alcohol or drugs, particularly cocaine and phencyclidine [phenylcyclohexylpiperidine (PCP)]. It must also be effective against individuals who are mentally disturbed.

Several less-than-lethal weapons have been tried or are in use by various law enforcement agencies. Some of the more popular include the following:

Tear Gas—The most commonly used preparations are chloroacetophenone, ethylbromoacetate, bromoacetone, bromomethylethylketone, and orthochlorobenzylidene malononitril. These substances are effective lacrimators and cause extreme irritation and edema of the mucous membranes of the nose and eyes. They have been used extensively for riot control and to induce a barricaded suspect to come out into the open. The greatest disadvantage of tear gas is that it loses its effectiveness in the wind and spreads over a wide area, therefore causing discomfort to innocent bystanders.

Capture Net—A device designed to be thrown over an individual and entrap him or her by tightening the draw ropes. In order for this device to be useful, the time must be available to assemble the necessary officers and prepare the net. This extensive time and preparation severely limits its usefulness.

Immobilizer—This device consists of two long poles connected by a chain. It is used in a fashion similar to that for the capture net but also has the same disadvantages, in that time is necessary to assemble the equipment and the officers.

Stun Gun—A weapon described as an electrical self-defense device which sends out 50 000 V to the body when pressed against the skin. It is powered by a 9-V battery and sends out only 20 mA. The victim is stunned, loses control of all voluntary muscles, collapses, and remains dazed and rubbery-legged for a few minutes. The overall effect is similar to that of the Taser. The effect is similar because the stun gun uses the same electrical source. The difference is that the stun gun has to be placed next to the suspect's skin for it to work, while the Taser can be fired like a gun.

Pepper Fog—Pepper fog consists of a mixture of cyclohexanol and sunthene mixed with either chloroacetophenone or with orthochlorobenzal malononitrile. It is similar to tear gas in that it affects the mucous membranes and it has the same limitations. In addition, it requires bulky equipment.

Slippery Material—This material is spread in the street, creating a coating that will cause anyone to slip and fall and not be able to walk, run, or maintain his balance. Unfortunately, this material can cause a person to fall, hit his head, and cause a fracture of the skull or other injury.

Water Cannon—This weapon consists of a high-pressure water nozzle on a mobile pumper. It is an effective weapon, but expensive and not very mobile. It is used most frequently for riot control.

Mace—Mace is a chemical disabling agent which when sprayed on the face and eyes produces tearing, numbness, and temporary blindness. It is composed of a solution of chloroacetophenone mixed with 2,2,2-trichloro-1,1,1-trifluoroethane, and 1,1,1-trichloro-2,2,2-trifluoroethane. It is effective only at very short range and suffers from the same disadvantages as tear gas.

Wooden Plug Gun—A device or weapon that fires wooden plugs instead of bullets. The missile is designed to hurt the subject so that he or she can be brought under control by the police. It is not designed to penetrate the skin or to cause serious injury. The disadvantage is that a suspect under the influence of PCP or other drugs may not feel the wooden plugs because of sensory blockade, thus negating the usefulness of the weapon.

Rubber Plug Gun—This device is essentially the same as the wooden plug gun, except that the missiles are rubber instead of wood. Therefore, it suffers from the same disadvantages as the wooden plug gun.

Ricochet Cartridge—A shotgun shell loaded with putty instead of shot. It is designed to strike the pavement and spatter. It is a useful weapon in crowd control but has little effect on an individual under the influence of drugs.

Other devices that have been tried include the riot baton, tranquilizing darts, and fluid projectiles. As yet, no single weapon has been developed which is simple, effective, and reliable and which has gained the confidence of the user.

The Taser

The Taser is a hand-held electrical control device, or electronic immobilization gun, which fires darts that deliver an electrical charge to the target. It is an effective, close-range weapon that does not depend on damage or destruction of tissue or organs to be effective. It is designed to shock and immobilize an uncontrollable subject without causing injury or permanent harm. Because the device fires darts, it is classified as a firearm by the federal government and has been designated a weapon by the California courts [1].

Essentially, the Taser consists of an electrical source which is powered by batteries and two cartridges (Figs. 1 and 2). Each cartridge contains two darts or barbs which are attached to 18 ft (5.5 m) of wire. The device weighs 1½ lb (680 g) and has a length of 9 in. (23 cm) and a maximum range of 18 ft (5.5 m).

The weapon is fired by pressing a thumb-operated release bar or trigger which explodes a small gunpowder charge, ejecting the two barbs contained in one of the cartridges. The barbs have an initial muzzle velocity of only 55 m/s. If both barbs strike the target, an electrical circuit is completed and current is transmitted from the batteries to the target. As long as the trigger is depressed, the current will continue to flow until the batteries run down or the barbs become dislodged from the target.

The barbs penetrate only ¼ in. (6.4 mm), but an electrical arc or spark of 1½ in. (38 mm) is produced at the end of the barb. Therefore, the barb does not have to be embedded in the skin for the weapon to be effective; the current will easily pass through clothing (Figs. 3 and 4). As long as both barbs are embedded in the skin or clothing, the weapon should be effective.

The trigger should be depressed only long enough to subdue the suspect totally; then the current should be stopped in order to allow him or her to recover. The manufacturer recommends that the current be applied for only 2 to 3 s. Once the suspect is immobilized, the officers should move in quickly and apply restraints before the suspect recovers from the effects of the electricity.

In keeping with Los Angeles Police Department's policy of using the minimum amount of force necessary to control a violent suspect, the Taser has been used in tactical situations where a firearm is not warranted but where it is unsafe for an officer to approach within contact range of the suspect and where previous attempts to control the suspect by more conventional methods, such as verbal commands and compliance holds, have failed.

The Taser has been successful 80% of the time it has been used by the Los Angeles

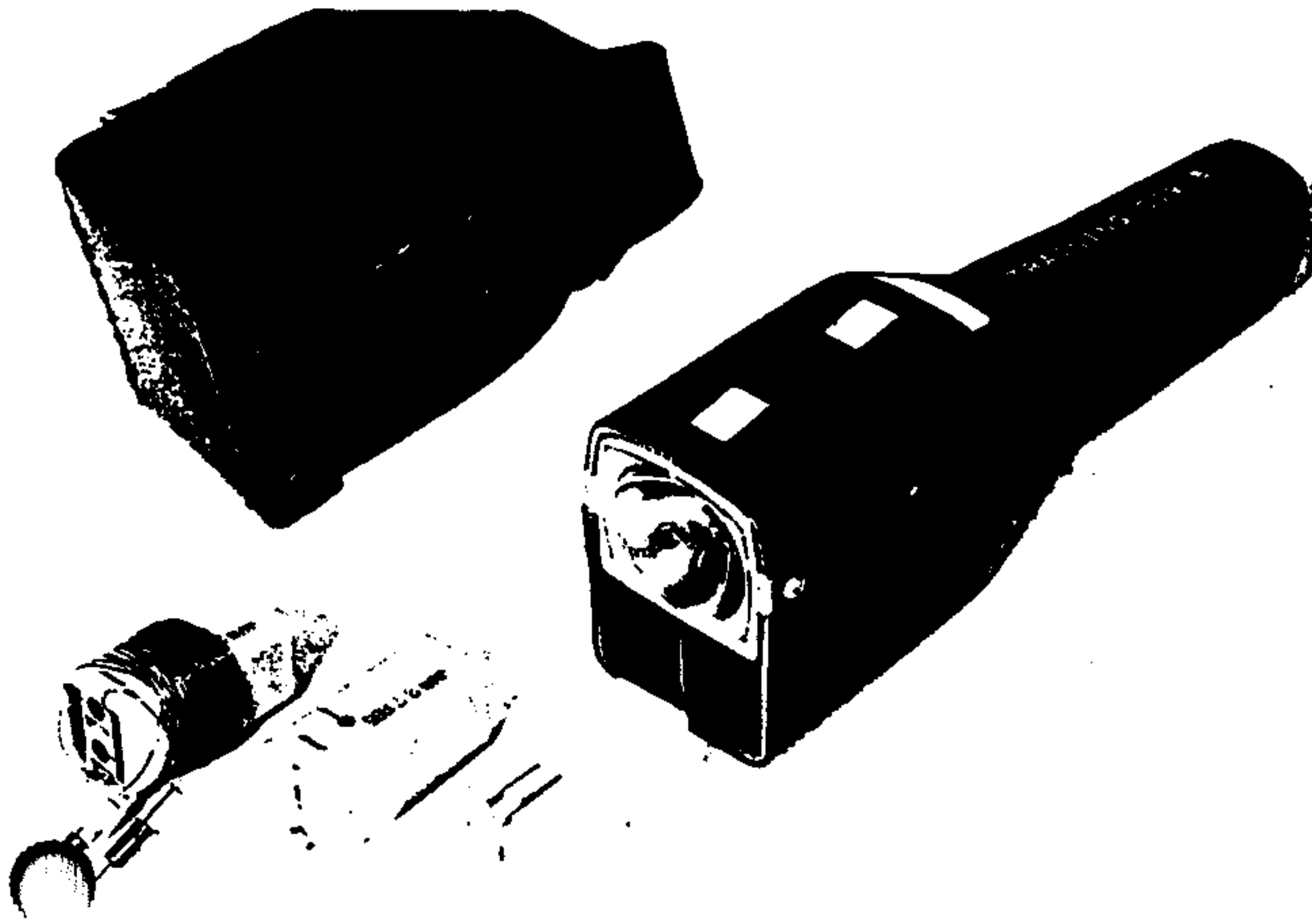


FIG. 1—*Taser and cassettes.*

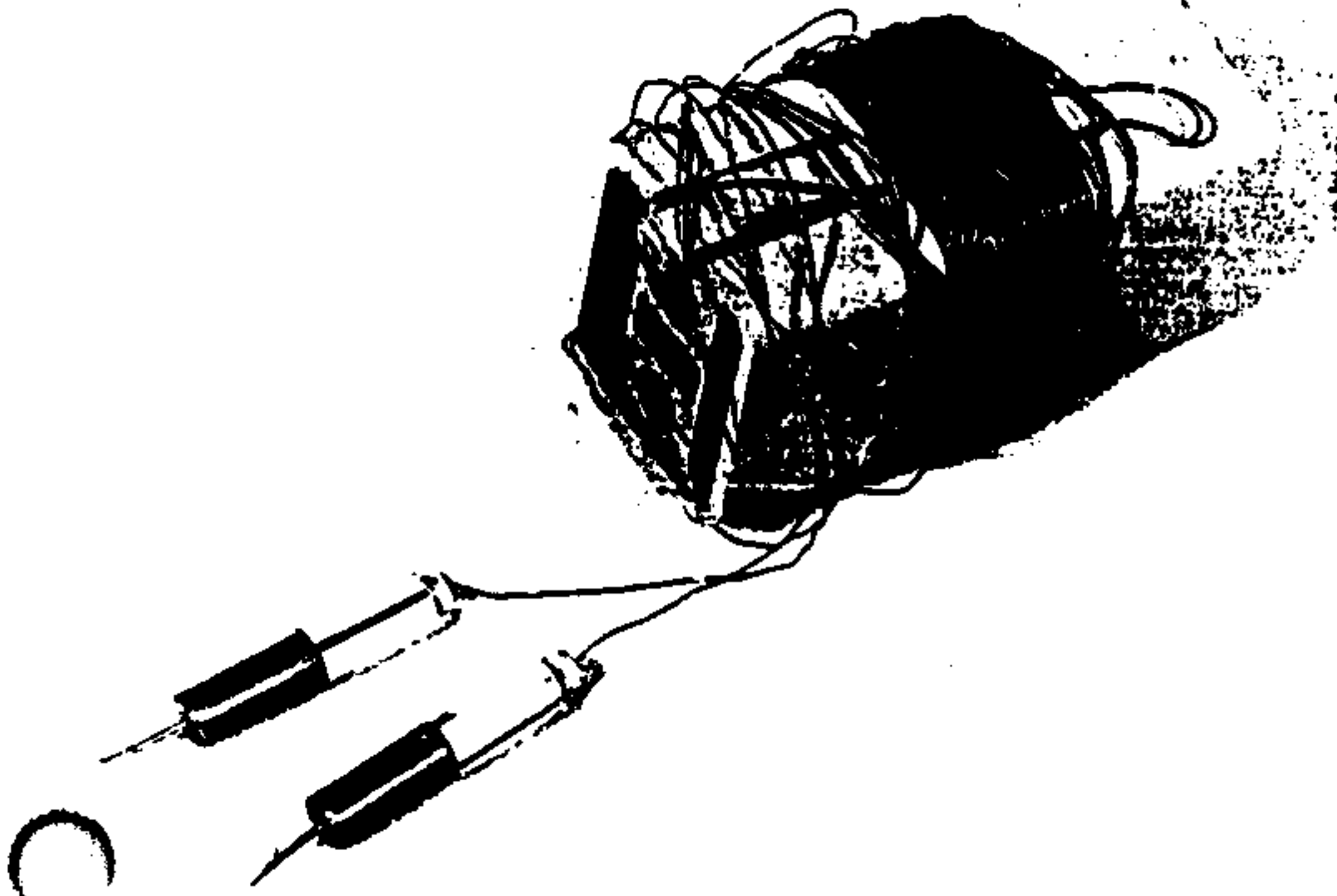


FIG. 2—*Close-up of the cassette, wire, and pair of barbs.*

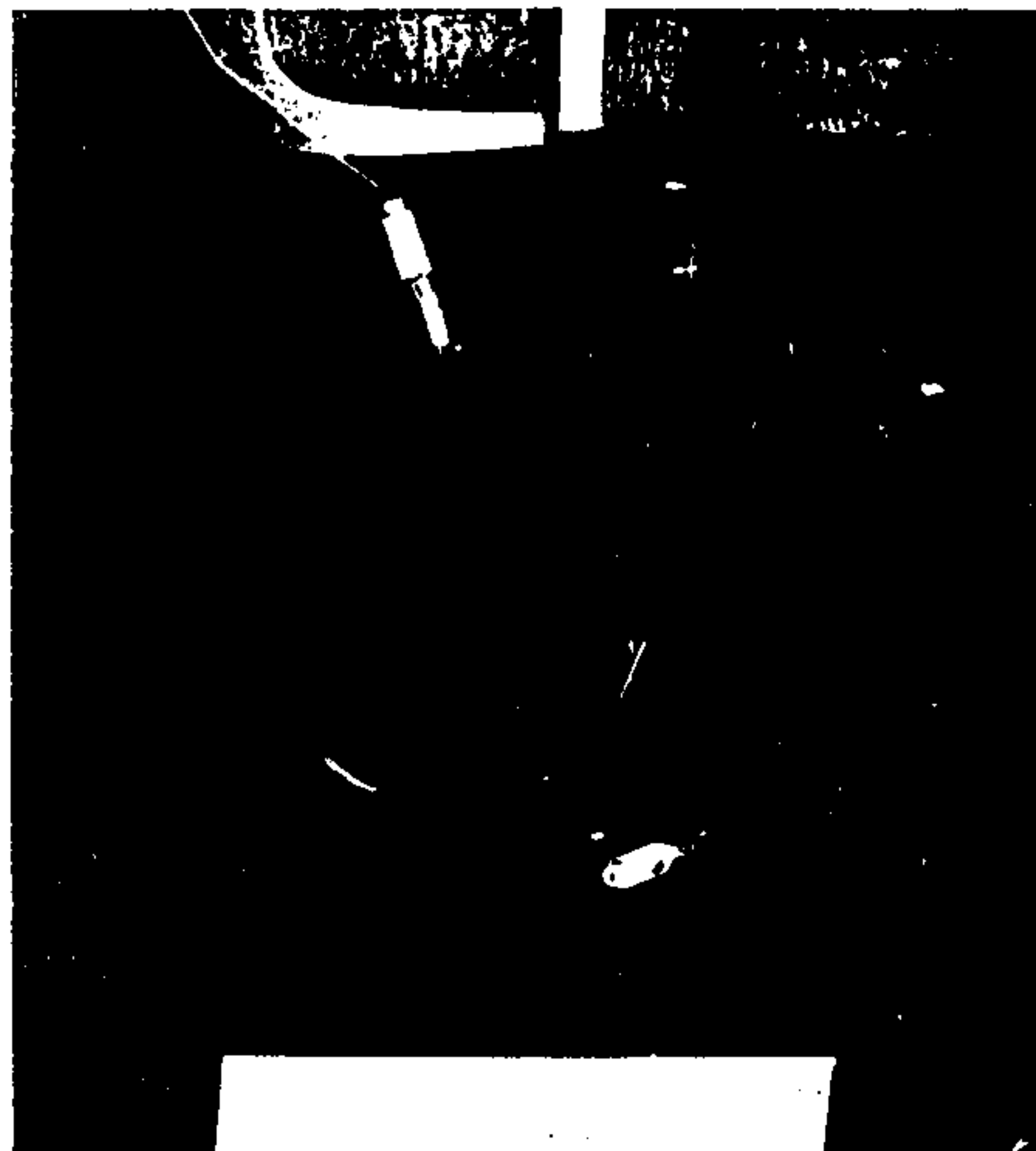


FIG. 3—Taser barbs embedded in trousers. The 1 to 1½-in. (25.4 to 38-mm) spark makes the Taser effective.

Police Department. In those instances in which it did not work, several reasons can be advanced, the most important one probably being poor contact between the barb and the target. Some form of insulation can be present between the skin and the barb which would decrease or negate the charge. Also, the charge delivered to the target can be below the level required to freeze the subject because the batteries have run down or there is some other electrical problem.

The energy source for the Taser is provided by a 9-V nickel-cadmium battery, which is capable of delivering 50 000 V at 20 mA. Electrical pulses are produced by a capacitance discharge similar to a photographic strobe and occur at 10 pulses per second and 0.3 J per pulse. The pulses can be delivered continuously for several minutes before the battery becomes discharged and the weapon is rendered ineffective. The average amount of energy delivered to the target is approximately 3 W [2].

The physiological effect of the Taser on the target subject should be immediate; however, a 3 to 5-s exposure to the current is recommended to ensure complete immobilization and a sluggish recovery. This should allow the officers enough time to subdue and restrain the subject. The electrical current causes tonic and clonic muscular contractions which persist for as long as the current flows. The subject falls to the ground helpless and incapacitated; he or she should be unable to stand, move, or resist in any way. The generalized muscular contraction involves the entire skeletal muscle system. If the suspect is still able to resist after the current has been turned off, the trigger can be depressed again—as long as the barbs are still attached to the target, the muscle contractions will begin again. Under ordinary circumstances this process is temporary and completely reversible. The subject should recover completely and should sustain no permanent aftereffects [3].

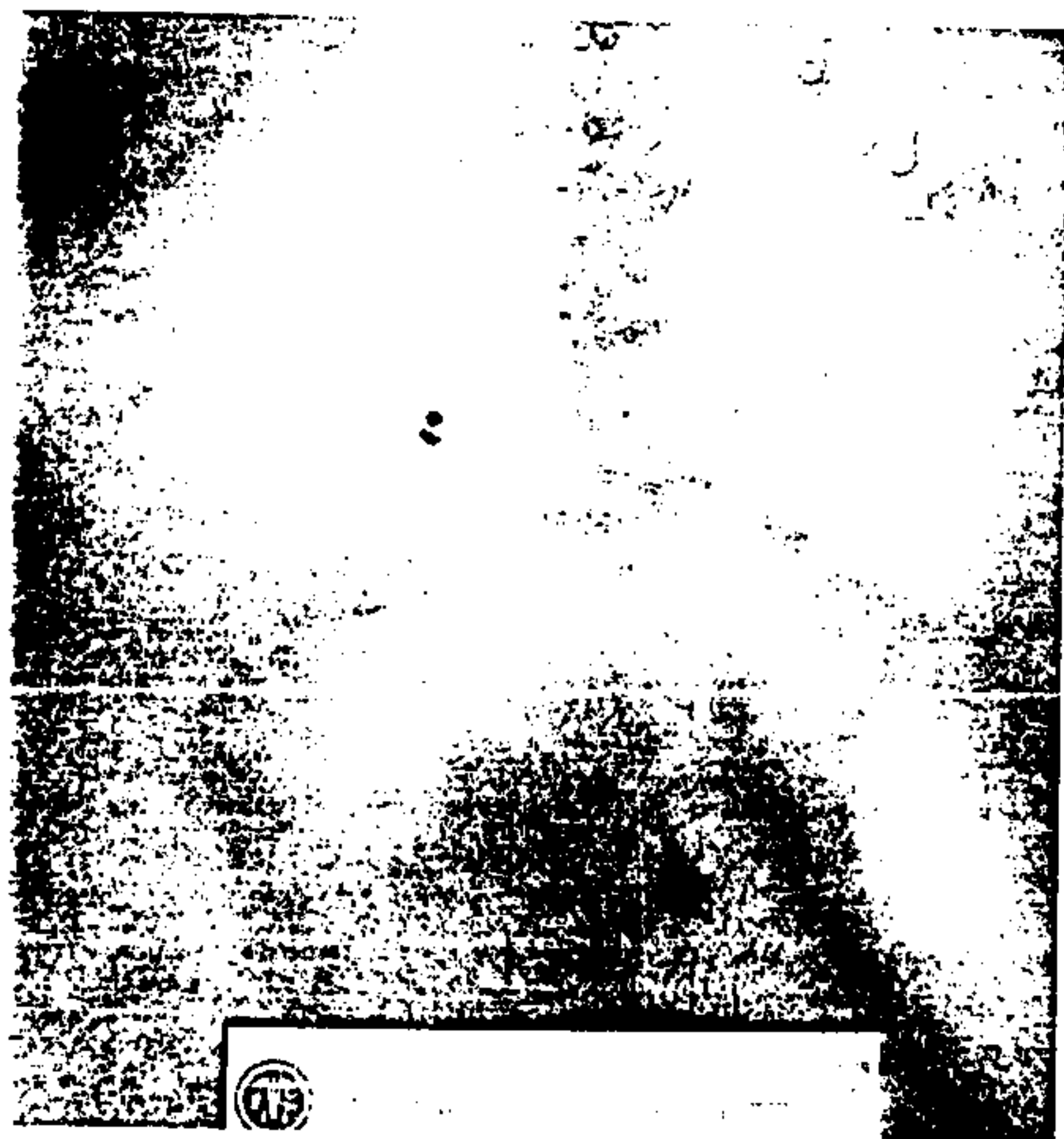


FIG. 4—Appearance of Taser wounds in the skin.

The neuromuscular stimulation caused by the electrical current is the result of depolarization of the muscle cells and is both painful and fatiguing. The level of current is above the "let-go" level and therefore is of sufficient magnitude to freeze or immobilize the subject for as long as the current is flowing [4].

Electrical current can be conveniently divided into three levels from the point of view of human perception. The lowest level is called the "threshold of perception" and is the level of electrical current at which an individual may feel a slight tingle but should have no startle reaction, pain, or other ill effects. This level has been found to be 0.5 mA for a 60-Hz current [5,6]. Currents above this level cause a startle reaction [5].

The next important level of current is called the "let-go" current and can be defined as the maximum level of electrical current that an individual can tolerate and still be able to let go of the electrical source by using muscles directly stimulated by the current [4,7]. This level has been determined to be a minimum of 9 mA for men at 60 Hz [8]. Currents in excess of one's let-go level are said to "freeze" the victim to the circuit [6,7]. Such currents are very painful, frightening, and hard to endure. The average person is frozen at a current level slightly in excess of the let-go level. Volunteers report that the current is so painful and causes such severe muscular contractions that it is incapacitating [2]. The legs of the volunteers buckle and they fall to the ground; it takes several minutes for a person to recover.

The lethal current level is the amount of current necessary to cause ventricular fibrillation, which is the most common mechanism of death associated with electrocution. The amount of current necessary to cause ventricular fibrillation varies depending upon the duration, frequency, and magnitude of the current. It also depends upon the body weight [9,10]. The threshold for ventricular fibrillation has been determined to be approximately 150 mA for 1 s at 60 Hz [11]. For shocks applied for more than 2 s, the level is believed to be 50 mA [12].

The Taser has an electrical output which ranges from 3 mA [5] up to 10.9 mA [3]. These levels are well below the amount needed to cause ventricular fibrillation. Therefore, there is a wide range of safety between the Taser output and the level of current necessary to cause ventricular fibrillation. According to the U.S. Consumer Product Safety Commission, an alternating current of 60 to 120 mA at 120 V and 60 Hz is necessary to cause ventricular fibrillation. The available electrical current generated by the Taser is not lethal when the weapon is used as directed on an average, healthy adult [3]. The same report cautions, however, that there may be cases of death because of individual susceptibility, as is the case with any device that delivers an electric shock. The commission points out that this margin of safety would be decreased in a person with arteriosclerotic cardiovascular disease, who could be subject to cardiac decompensation from a combination of electrical shock and convulsive seizures. The margin of safety could also be reduced if the duration of the current was prolonged.

Profile of the Victims

During the five-year period of 1983 through 1987, 16 deaths associated with the use of the Taser gun were recorded in Los Angeles County. The deceased in each instance was a young male between 20 and 40 years of age. Mexican Americans accounted for 5 deaths, blacks for 8, and whites for 3. Most had a criminal record usually associated with burglary or drugs. All were known to abuse illicit drugs. Several had been incarcerated at one time or another. They were unarmed or else armed with a weapon usually not considered dangerous, such as a screwdriver or a frying pan. Each was engaged in some form of bizarre or unusual activity which necessitated calling the police; they were all engaged in this activity when the police arrived.

The following is a list of the activities engaged in by the deceased when confronted by the police: hugging and kissing a lamp post, pulling a telephone off the wall and brandishing it as a weapon, dancing in the street, stabbing the ground with a screwdriver, destroying furniture, wrecking a motel room, fighting with and cursing at an unseen individual, lying in the gutter with hands and feet flailing, walking erratically and blowing on a whistle, driving erratically, shouting religious obscenities, creating a disturbance, and jumping up and down on a parked car.

In these activities the subject usually was acting alone and not threatening another person except in two instances: in one case the subject was threatening his mother and in another case a prowler trapped in an alley was attacking the police officers with a frying pan. Individuals who are unarmed, acting in a bizarre or unusual fashion, and not threatening any other person are usually considered by the police to be under the influence of PCP. Consistent with the policy of using the minimum amount of force necessary to control a situation, the officers used Tasers to try to subdue the subject. In each case, what started out as a relatively benign situation escalated into a belligerent confrontation with the police and eventually resulted in the death of the suspect.

Jurisdictionally, 10 cases occurred in the Los Angeles Police Department area, 4 cases in the Los Angeles Sheriff's Department area, 1 case in Pomona, and 1 case in Beverly Hills.

The causes of death are listed in Table 1, as is the manner of death.

Taser wounds were seen on each body and ranged in number from one to eight. Abrasions consistent with an altercation were noted in all 16 cases; in addition, 8 showed contusions and 4 showed lacerations. Fractures were noted in 4 cases and baton marks in one. Restraint marks were seen on the wrists and ankles in 8 cases. Gunshot wounds were seen in 3 cases.

TABLE 1—Summary of 16 deaths associated with Taser use.

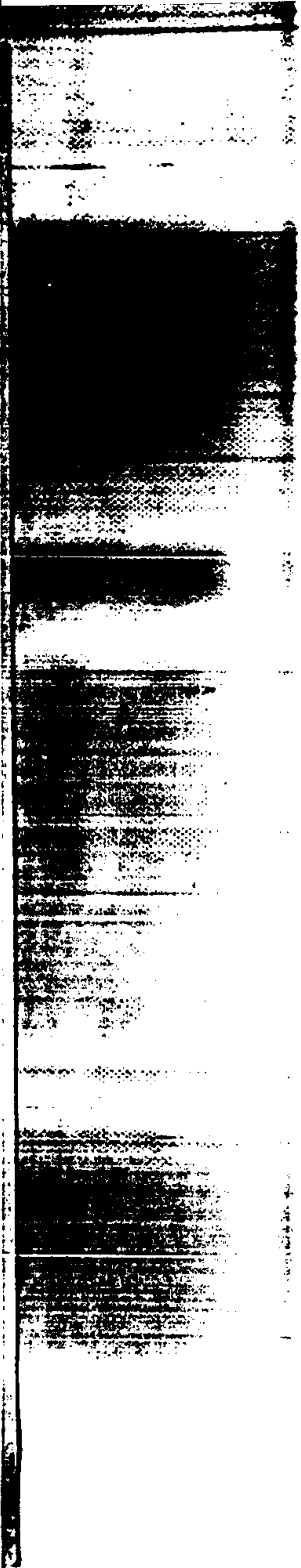
Case No.	Age	Sex	Race ^a	Cause of Death	Manner of Death	Drugs Detected	Time Interval Between Taser and Death	Number of Taser Cassettes Fired
1	27	M	M	cardiac dysrhythmia/acute PCP intoxication	accident	PCP	15 min	1
2	30	M	M	cardiac decompensation during restraint procedure with blunt force trauma	homicide	lidocaine	30 min	1
3	35	M	B	cardiomyopathy idiopathic with acute myocarditis	homicide	PCP and digoxin	45 min	1
4	34	M	B	cardiac arrhythmia, sick sinus syndrome, prolapse of mitral valve, and electrical (Taser) stimulation while under the influence of PCP	accident	cocaine and benzoyllecgonine	3 h	3
5	35	M	B	acute cocaine intoxication	accident	Cocaine and benzoyllecgonine	2 h	1

TABLE 1—Continued.

Case No.	Age	Sex	Race ^a	Cause of Death	Manner of Death	Drugs Detected	Time Interval Between Taser and Death	Number of Taser Cassettes Fired
6	37	M	W	cardiac arrest due to multiple Taser wounds/acute cocaine intoxication	homicide	cocaine and benzoylecgonine	45 min	7
7	31	M	W	acute cocaine and PCP intoxication	accident	alcohol, cocaine, PCP, and benzoylecgonine	75 min	4
8	28	M	B	hepatic necrosis and renal failure due to acute cocaine and chronic drug and alcohol abuse	accident	cocaine, benzoylecgonine, and morphine	2 days	1
9	26	M	M	multiple gunshot wounds	homicide	PCP	15 min	3
10	20	M	M	multiple gunshot wounds	homicide	none detected	15 min	2
11	27	M	M	acute PCP intoxication	accident	alcohol and PCP	15 min	1
12	37	M	B	multiple drug intoxication	accident	alcohol, PCP, and cocaine	45 min	1
13	36	M	B	cardiac arrest during restraining procedures and PCP intoxication	homicide	PCP	3 days	2

14	M	27	W	multiple injuries and methamphetamine intoxication	homicide	methamphetamine and amphetamine	30 min	multiple		
15	M	27	B	multiple gunshot wounds	homicide	none detected	15 min	1		
16	M	39	B	PCP intoxication, esophageal airway obstruction and blunt force injury to neck	homicide	PCP	30 min	2		

*M = Mexican American; B = black; W = white.



Other pathology which was found at autopsy included an enlarged heart, which was found in 4 instances. The largest heart weighed 535 g. One case showed degeneration of the mitral valve; this person had a history of mitral valve prolapse, cardiac arrhythmia, and syncope. Other than pulmonary edema and congestion, no one showed any pulmonary lesions. One case showed hepatomegaly and one showed hepatic necrosis. Sick cell trait was observed in 1 case, needle tracks of the antecubital fossae in 3 cases, and chronic pancreatitis in 1 case. One case showed an old healed fracture of the wrist with a plate and screws in place. Only 5 of the 16 cases were free of other pathology.

PCP was found in 8 cases, cocaine in 6, and amphetamine in one. In 13 of the 16 cases, drugs were found in the system at the time of autopsy. No drugs were recovered in 3 cases. In one of these, the individual survived in jail for two days; in the other 2 cases the individual died in the street.

Taser Pathology

Grossly, the lesion produced by the Taser barb consists of a superficial punctate penetration of the skin, which may or may not be surrounded by erythema (Fig. 5). The longer the interval of time between the Taser wound and death, the greater the erythema. On the cut surface, the penetration extends to less than $\frac{1}{4}$ in. (6.4 mm) and is usually surrounded by a thin zone of homogeneously coagulated tissue.

In microscopic sections, subepidermal bullous formation at the margins of the punctate wound, with separation of epidermis from the dermis, is noted. The nuclei of the epidermal cells show severe pyknosis. The dermis shows homogenization of the collagen due to burn effect (Fig. 6).

The capillaries are dilated and filled with fluid; some even show occlusion. In some cases there is extravasation of red cells below the homogenized area into subcutaneous adipose tissue. An inflammatory cell infiltrate was not seen in any case; however, since

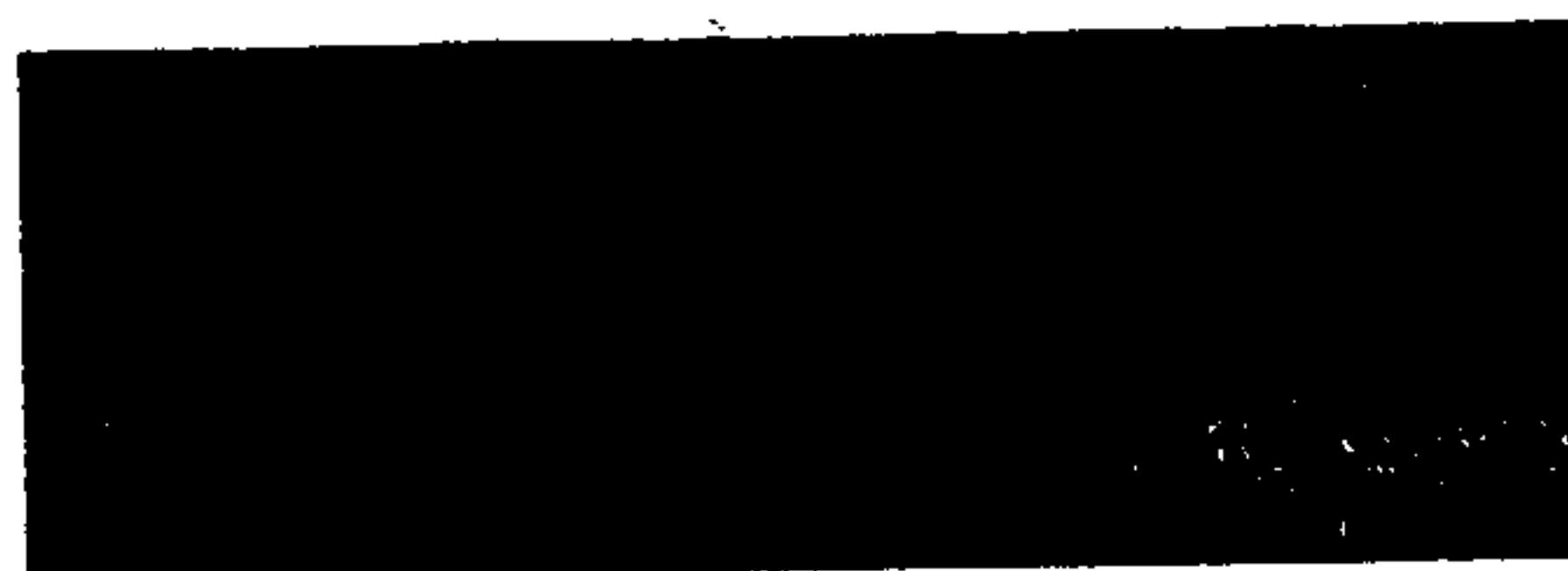


FIG. 5—Section of skin showing a penetration wound from the Taser barb.



FIG. 6—Microscopic view of a Taser wound in skin showing loss of epithelium and homogenization of collagen.

death occurred within a very short time after the taser was fired, this would not be unexpected.

Discussion

Drugs, specifically cocaine, PCP, or amphetamine, were found in all but 3 cases. One individual without drugs was initially pursued as a prowler, but when trapped in an alley, he displayed unusual behavior and attacked the officers while wielding a metal frying pan. Because of this behavior, he was considered to be under the influence of PCP by the police officers, and a Taser was fired at him. After the attempts to subdue him by Taser had failed, the officers shot him to death.

No drugs were found in the system at autopsy in a second case, but the person had been in jail for several days prior to his attack on prison guards. At that time, he displayed bizarre and unusual behavior in that he pulled a telephone off the wall of the facility in which he was housed and began to attack the guards with it. A Taser was fired at him, but it had little or no effect on his behavior. He was finally subdued by a choke hold and expired shortly thereafter. The cause of death was listed as cardiac decompensation during restraining procedures with blunt force trauma. Acute myocarditis was listed as a contributing cause.

A third case involved a young man who was jumping up and down on a car and screaming incoherently. When police fired a Taser at him, he is reported to have remarked "Ooh, feels so good." He began to fight the officers and was eventually shot to death.

Aside from injuries sustained in confrontation with the police and the use of the Taser, these deaths vary only slightly from those caused solely by cocaine or PCP. The biggest difference is in the amount and type of injury sustained. All of the subjects of these cases sustained injury in some form, varying from a few superficial abrasions to fatal gunshot wounds. Deaths which occur solely from drugs do not, as a rule, have other wounds. Because of the levels of drugs found, the cause of death could be attributed to an overdose in 13 of the 16 cases.

The sudden death syndrome has been postulated as the mechanism of death in individuals who succumb after a manic combative state [13]. Such individuals die while being restrained, or shortly thereafter, and the deaths have been referred to as acute exhaustive mania. Some reflect mechanism which begins in the state of mind of the victim is postulated as the mechanism of death in such cases [13]. An adrenal hormone, epinephrine or catecholamine, is secreted into the circulation and travels to the heart. The heart, being very sensitive to such hormones while in a state of mania, may be triggered into an episode of ventricular fibrillation [13].

Sudden death from cocaine psychosis has been postulated as the cause of death by pathologists in Dade County, Florida, in cases of sudden unexpected death associated with bizarre behavior and highly combative activity [14].

The common thread to almost all in-custody cases in which the subject dies during or after an altercation with the police and in which violent, combative, or bizarre behavior is involved turns out to be drugs. The individual has a history of drug abuse or has drugs found in his system at the time of death. The other factor is bizarre behavior. All of the individuals in this series of cases displayed bizarre behavior: 13 out of 16 had cocaine, PCP, or amphetamine in their system.

Although two cases were certified as being caused by electrical injury, in one of these cases at least, the level of cocaine was sufficient to explain the death. This person was standing in water and was hit with eight Taser darts. The number of darts should not be a determining factor, since the electrical current is not cumulative. The pathologist handling the case took into consideration the number of darts as well as the fact that the victim was standing in water during the confrontation. The fact that the electrical current had little or no effect upon the victim was not considered. The effects of drugs apparently also were not considered. No other reason for the death was found at autopsy; therefore, this death clearly fits into the cocaine category.

The second case is another matter. In this instance, the subject had a history of heart disease. A heart murmur was first noted at age 12, associated with fluttering and palpitations of the chest. Despite these findings, he was active in sports during his youth and adolescence. Two years prior to his death, the subject was involved in a minor traffic accident caused by an episode of syncope and cardiac arrhythmia. He was admitted to a hospital for evaluation where a Grade 1 to 2 systolic murmur was noted over the precordium and an electrocardiogram (EKG) showed atrial arrhythmia and premature beats.

Cardiology consultation noted syncope secondary to cardiac arrhythmia and mitral regurgitation secondary to mitral valve prolapse. The patient was advised to have a pacemaker implanted but he refused. He was discharged from the hospital with a diagnosis of the sick sinus syndrome and a guarded prognosis because of the possibility of repeated syncopal attacks and ventricular fibrillation.

At autopsy, an enlarged heart was noted with mucinous degeneration of the mitral valve. On microscopic examination, there was noted mucinous degeneration of the mitral valve area, eosinophilic fragmentation of the myocardium, and patchy foci of myocytolysis and interstitial fibrosis in the heart tissue.

PCP was also found in the blood, bile, and liver and, therefore, the cause of death could be attributed to the PCP. However, the subject's heart condition was such that he could have suffered a fatal arrhythmia from the PCP, the excitement, the electrical stimulation, or a combination of any or all of these factors. The cause of death was, therefore, certified as cardiac arrhythmia due to sick sinus syndrome, prolapse of the mitral valve, and electrical (Taser) stimulation while under the influence of PCP.

The different causes of death listed in Table 1 indicate the confusion and uncertainty in the minds of the pathologists who have the responsibility of completing the cases. Even in the same office there was considerable variation in the wording of the cause of death. The same problem emerges again in the manner of death. In 9 cases the manner of death was certified as homicide, while in 7 cases it was listed as an accident.

Injuries to the eye have been postulated as a result of the eyeball being punctured by a dart [8]. No case is reported here and none could be found in the literature. If a Taser barb penetrates the globe of the eye and subsequent rupture of the globe occurs, then blindness is a possibility. Electrical stimulation to the eye in such a case has also been postulated to cause blindness [8].

Injuries to the skin caused by the barbs are not considered serious since they penetrate only approximately 1/4 in. (6.4 mm). No reports of skin injuries or complications were found in the literature. Most of the known wounds have appeared in the chest, abdomen, back, or thighs, the large areas of the body where the police are instructed to fire the darts. No reports of injuries to the neck, face, or other sensitive body areas have been found, and none are reported in this group of cases.

A third major area of potential concern is injury from falls sustained during the period of seizure and incapacitation. We did not encounter any deaths which could be attributed directly to a fall. In all 16 cases, the subjects sustained injuries which consisted mostly of superficial abrasions, lacerations, and contusions. All of these injuries could be attributed to struggle with the police officers and not to a fall or another form of injury. In most of the cases the injuries were clearly referable to some source other than falling after being hit with a Taser.

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