

## Electronic Gun (Taser®) Injuries

*The Taser® is an electrical weapon used for immobilization. Two hundred eighteen patients who were shot by police with a Taser® for violent or criminal behavior were compared to 22 similar patients shot by police with .38 Specials. The long-term morbidity rate was significantly different for "tasered" victims (0%) and for those with bullet wounds (50%) ( $P < .05$ ). The mortality rate was also significantly different between "tasered" victims (1.4%), and gunshot wound victims (50%) ( $P < .05$ ). Possible complications associated with Taser® wounds included contusions, abrasions, and lacerations (38%); mild rhabdomyolysis (1%); and testicular torsion (0.5%). Although 48% of "tasered" patients required hospitalization, all but one was for a preexisting injury or toxic or psychiatric problem. We conclude that Tasers® are relatively safe when compared to shooting with more conventional weapons. [Ordog G, Wasserberger J, Schlater T, Balasubramaniam S: Electronic gun (Taser®) injuries. *Ann Emerg Med* January 1987;16:73-78.]*

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### INTRODUCTION

Taser® (Thomas A Swift's Electric Rifle) guns<sup>1</sup> have been used by law enforcement officers for immobilizing violent suspects and those on drugs, especially PCP (phencyclidine [phenyl-cyclohexyl-piperidine]).<sup>2,3</sup> Similar electric rifles have been used by private citizens for self-protection. The Taser® gun is used because it is claimed to have the advantage of not permanently harming the victim, while at the same time immobilizing the victim and controlling violent behavior.<sup>4</sup> This prevents injury to others and alleviates the need to use physical force and bullets, which obviously produce more serious consequences. The Taser® is generally used when there is no immediate lethal threat to the police or bystanders and when proximity to and control of the suspect is required. If the suspect presents an immediate danger to others, such as threatening with a gun or knife, a .38 Special may be used according to established police protocols.<sup>4</sup>

The Taser® is an electrical gun that shoots darts (usually two or four) up to a range of 15 feet. The darts are connected to the gun by wires that deliver up to 50,000 volts (3 mA) to the victim. For maximum effect, the shaft should penetrate the skin where, because of barbs, the darts are not easily removed unless the skin is lacerated or ripped open. Immobilization of the victim occurs when the trigger of the gun is squeezed and current flows through the suspect's skin. Due to tetanic contraction of the muscles, the victim usually falls. The trigger can be squeezed as required to maintain immobilization. The barbs do not have to penetrate the skin for immobilization; only contact with the victim's clothing is required, and one barb is usually effective.

After Taser® immobilization, the victim is physically restrained, the wires to the darts are cut, and the victim is taken to the hospital for removal of the darts. The barb is like a fishhook and requires surgical removal.

The mechanics and ballistic properties of the Taser® have been discussed fully by Koscove,<sup>5</sup> but to date no clinical study has shown the effectiveness and safety of the Taser®.

### MATERIALS AND METHODS

We conducted a prospective case study of all patients brought to the emergency department of the King/Drew Medical Center in Los Angeles who had been shot with a Taser® gun between July 1980 and December 1985. Informa-

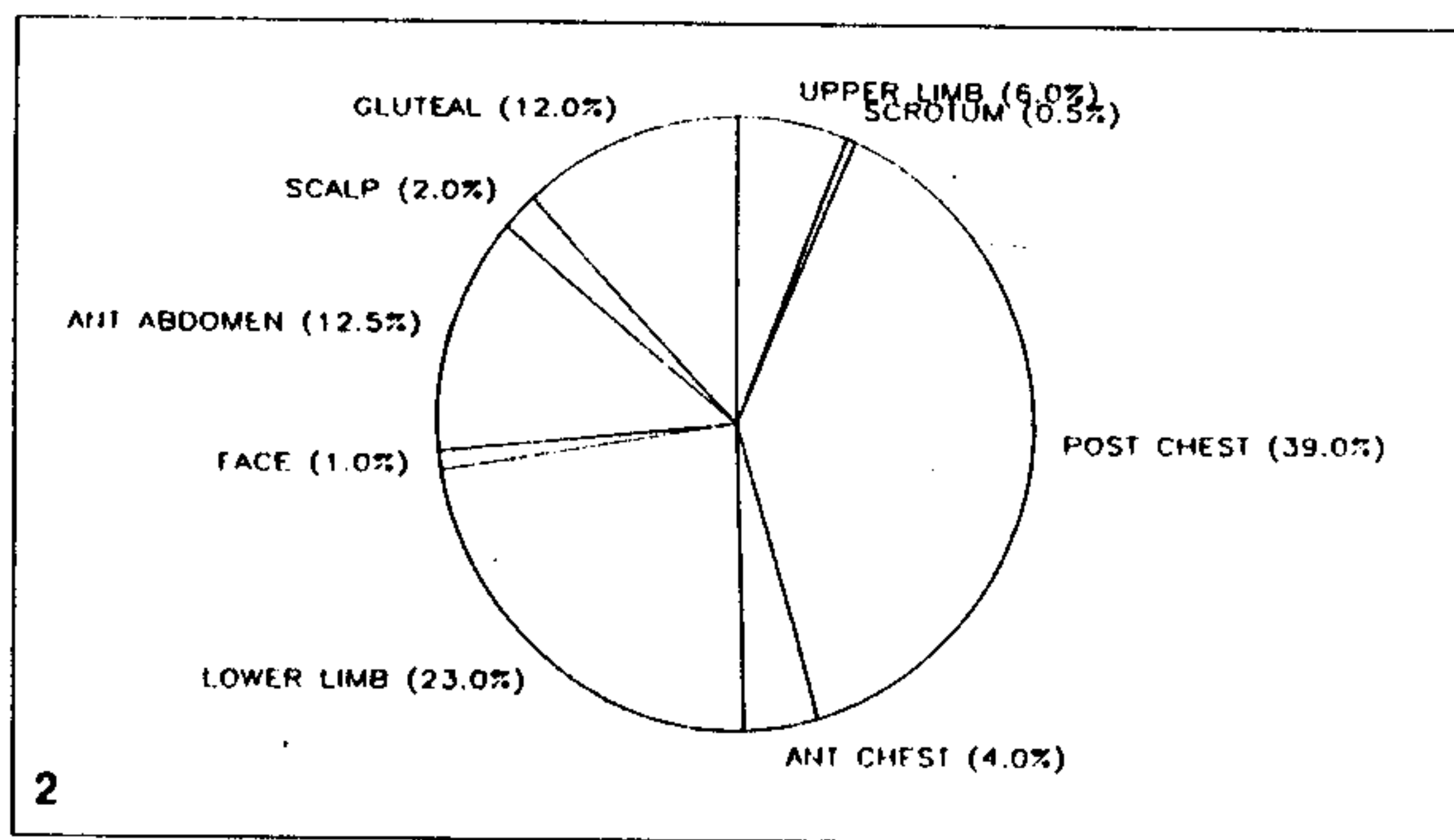
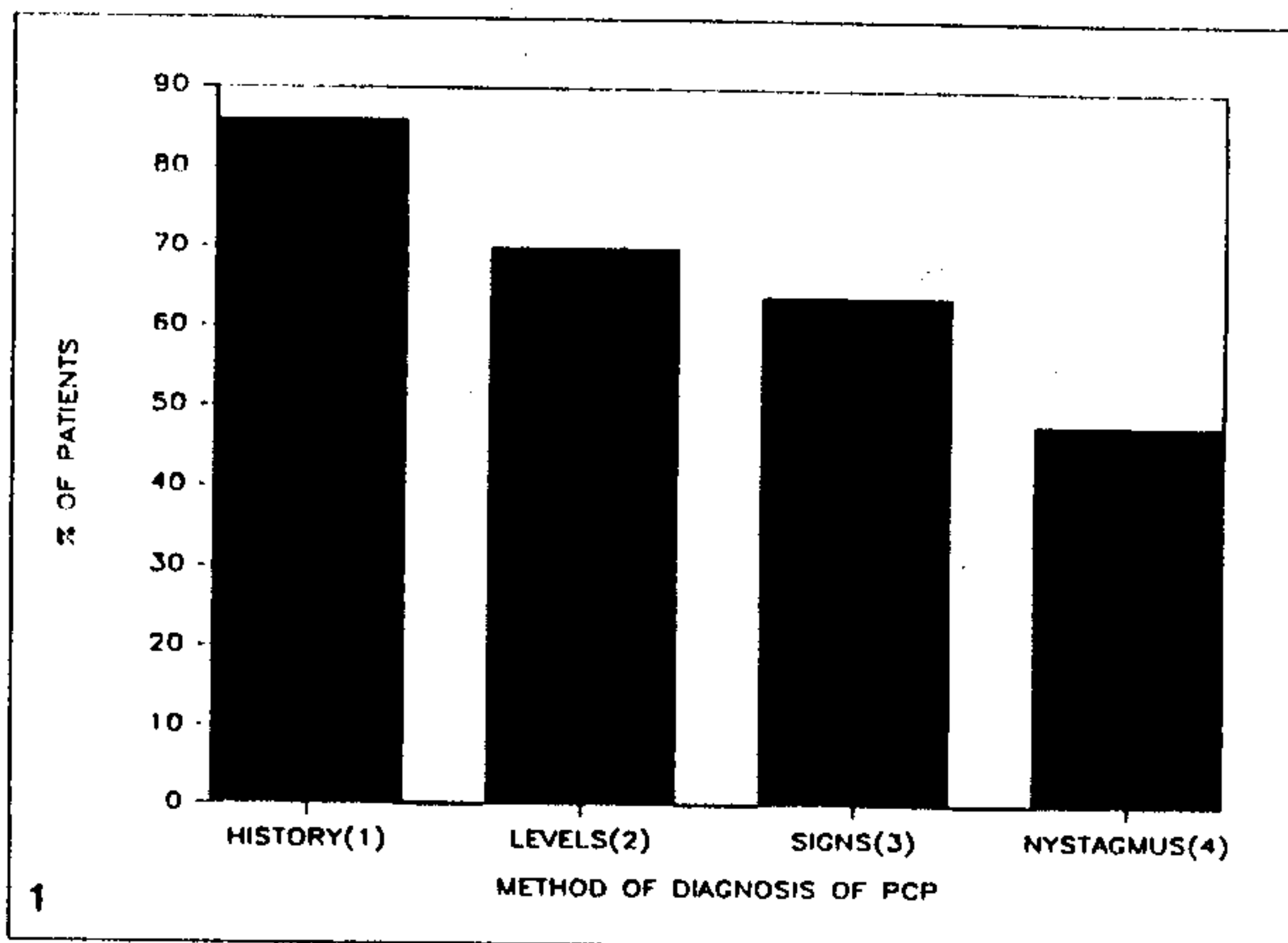
**FIGURE 1.** Toxicology of tasered patients with recent phenethylamine abuse. 1) Within 24 hours by history; 2) Positive urine or serum phenethylamine levels and liver levels in patients who died; 3) Physical signs of phenethylamine intoxication, including nystagmus, acute psychosis, hyperthermia, diaphoresis, and elevated blood pressure;<sup>2,3,8,16,17</sup> 4) Nystagmus with both horizontal and vertical components present.<sup>2,3,8,16,17</sup>

**FIGURE 2.** Anatomy of embedded Taser<sup>®</sup> darts.

tion was collected on age, sex, race, who shot the weapon, whether restraints were used, medical diagnosis, complications of Taser<sup>®</sup>, autopsy results, method of barb removal, and associated treatment. The patients who died had full autopsies performed by the Los Angeles County coroner's office to determine the cause of death. Patients included in the study were all those shot with a Taser<sup>®</sup> who presented to the King/Drew emergency department. None was excluded.

These data were compared to similar data on patients who were shot with .38 Special handguns by police officers for the control of either violent or criminal behavior and who were brought for treatment to the King/Drew Medical Center during the period from January 1980 to December 1982. Only patients who were shot by police officers were included. This was usually verified by the accompanying officer. All patients meeting these criteria were included, except those for whom only hearsay evidence indicated that it was an officer-related shooting and those not brought to the hospital after being shot by police who may have been handled by the coroner's office with no medical treatment. Patients were not aware that they were being studied, and consent was not required because treatment was rendered according to established protocols of standard medical practice. No blinding was used; 80% of clinical observations were made by the principal author, and the remainder were made by emergency medicine resident staff.

Statistical analysis included calculation of standard deviation, chi-square, and ANOVA (comparison of unequal groups) using an IBM-PC<sup>®</sup> and Statgraphics<sup>®</sup> program.



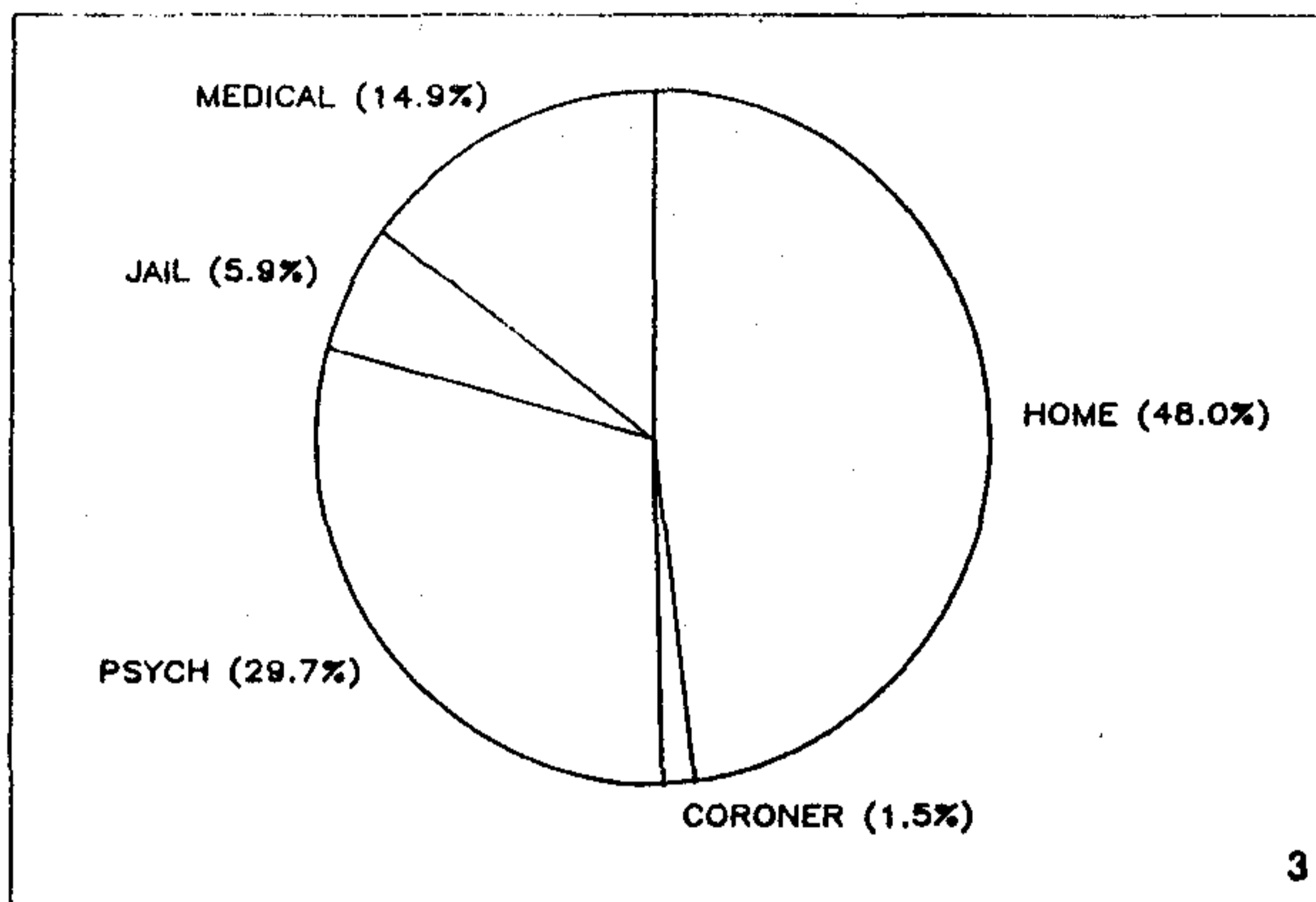
## RESULTS

### Taser<sup>®</sup> Injuries

Two hundred eighteen patients who were shot with Tasers<sup>®</sup> were included. The mean age was 28 years (standard deviation, 4.8; range, 15 to 48). Ninety-five percent were men. All were shot by police officers. In all cases, the guns used were manufactured by Taser<sup>®</sup> Industries Incorporated (El Toro, California). Ninety-nine percent of patients were brought in by police. Sixty percent were brought in with no paramedic or emergency medical technician (EMT) contact. Thirty-nine percent of patients were brought in by paramedics with police in escort, and 1% walked in on their own, presumably after being "tasered" by the police

and then escaping.

Of those brought in by police, 46% were in hard restraints (ie, thick leather binders on all limbs with keylocks). Twenty percent were shot because they exhibited violent behavior but were no longer restrained, and 7% were in custody for criminal offenses and were handcuffed. Seventy-six percent of all patients were "tasered" for bizarre and uncontrollable behavior (unusual but not necessarily directed violence); 40% for bizarre and extremely combative behavior (with directed violence); and 5% for bizarre and uncontrollable behavior with nudism<sup>2,3</sup> (Table 1). Sixty-eight percent of patients were put on a 72-hour psychiatric hold; half of them were



**FIGURE 3.** Tasered patient disposition. Home, discharged home from the emergency department after average stay of six hours; Psych, psychiatric admission, usually on a 72-hour involuntary hold; Medical, admitted to the medical service of the hospital for further treatment; Jail, released to police custody after treatment in the emergency department; and Coroner, all patients who died received autopsies by the Los Angeles County Coroner's Office to determine cause of death.



**FIGURE 4.** Officer in pose to fire Taser\*.

range of 100/70 to 160/100. The average pulse rate was 96/min (SD, 21), with a range of 80 to 160. Aside from the three "tasered" patients with asystole, no other cardiac arrhythmias were reported.

#### Other Treatment

Electrocardiography was performed on 38% of patients. All were normal for rhythm, except the three patients who had asystole. Forty-five percent of patients required tetanus prophylaxis. All darts were removed by incising the skin at the base of the shaft with a #11 scalpel blade. No suturing was required.

#### Complications

The mortality rate associated with Taser\* use was 1.4%. All three of these patients arrived at the ED in asystole. Taser\* darts were embedded in the anterior thigh, buttocks, and back in these patients. All three had high levels of PCP in both serum (0.156 to 0.43  $\mu\text{g}/\text{mL}$ ) and liver (0.44 to 0.76  $\mu\text{g}/\text{mL}$ ). One had a previous cardiac history, including cardiac arrhythmias (sick sinus syndrome with mitral valve prolapse), and was on digoxin. All three patients went into cardiac arrest after being "tasered." Two patients with no previous history went into cardiac arrest 5 and 15 minutes after being "tasered," and the third went into respiratory arrest followed by cardiac arrest 25 minutes after being "tasered." None responded to ACLS resuscitation.<sup>7</sup> The coroner's report for each of the three patients stated that death was due to phen-cyclidine toxicity, with no signs of myocardial damage, airway obstruction, or other pathology.

Thirty-eight percent of patients had

idence of recent cocaine use.<sup>6</sup> Five percent of patients had a psychiatric disorder unrelated to drug use and had negative drug screens (Figure 1).

#### Associated Diseases

Fifteen percent of patients had pre-existing diseases, including psychiatric disorder, sickle cell trait, mitral valve prolapse, cardiac arrhythmia, and sick sinus syndrome. The one patient with a previous history of cardiac disease had mitral valve prolapse, cardiac arrhythmia, and sick sinus syndrome.

Thirty-eight percent of patients had associated injuries, usually associated with the violent behavior from PCP intoxication. These injuries included multiple abrasions in 48 patients, stab wounds in 11 patients, and multiple lacerations (not due to knives) in seven patients. There were no bone fractures.

#### Darts

The number of darts fired by the police officers ranged from two to four, with a mean of 2.6 (SD, 1.3) per patient. The number of darts present in the patients' skin on admission to the emergency department ranged from one to four, with a mean of 2.3 (SD, 0.93) per patient. The anatomical distribution of the embedded darts is shown (Figure 2).

#### Vital Signs

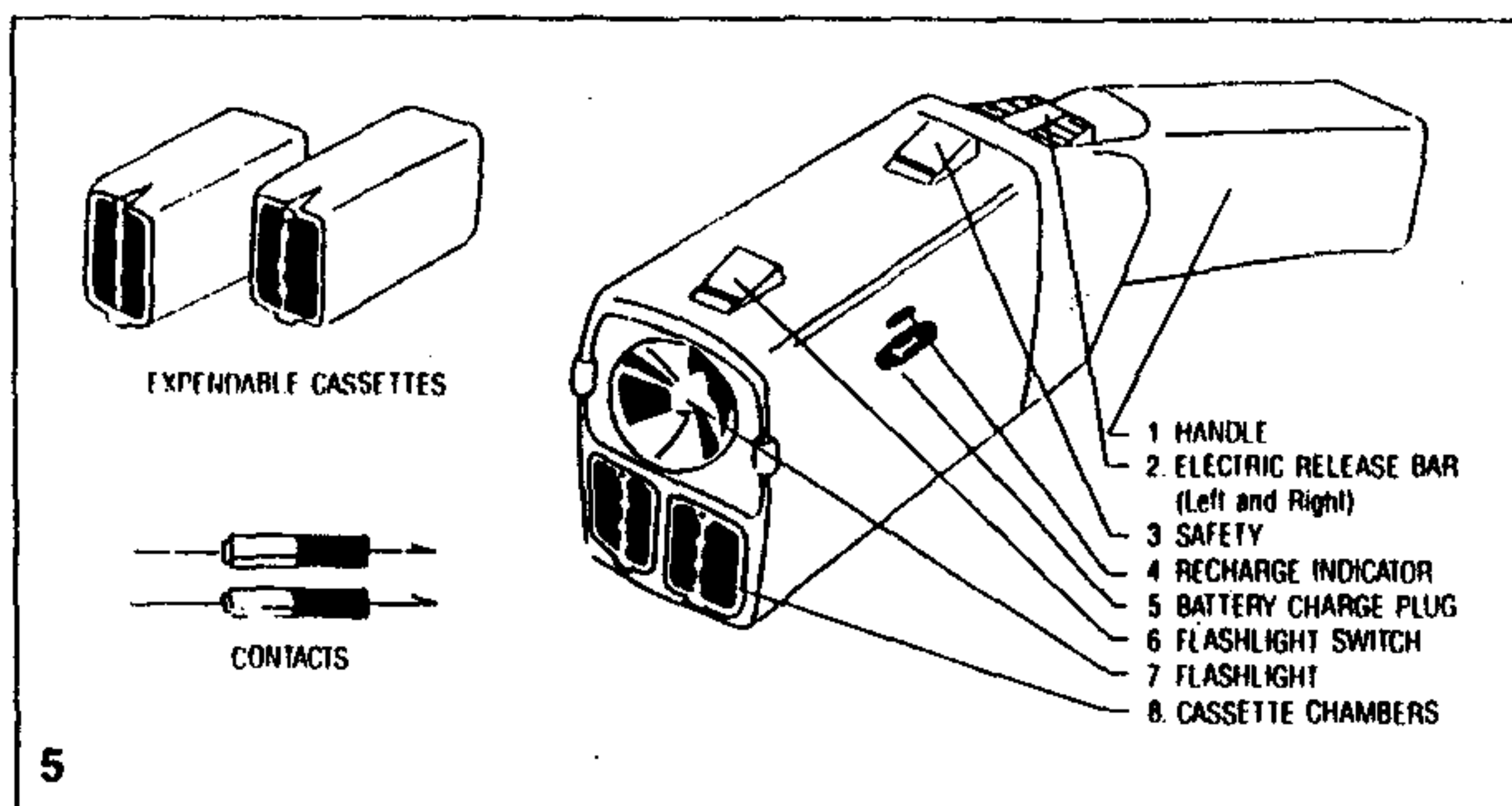
The average blood pressure of "tasered" patients on admission to the ED was 120/80 (SD, 15/16), with a

later released from the emergency department to go home.

#### Toxicology

Eighty-six percent of patients had a history of recent (same day) PCP use; 70% had positive levels of PCP; 64% had signs of PCP intoxication; and 48% had both vertical and horizontal nystagmus (strong evidence of PCP abuse).<sup>2,3</sup> Twenty-six percent of patients had positive ethanol levels, and 4% had a history and physical ev-

FIGURE 5. Diagram of Taser®.



associated injuries related to their violent behavior and not to use of the Taser®. Eighteen of the patients required suturing of wounds and 15% of all patients were admitted to the hospital for injuries sustained due to their violent behavior, primarily preexisting stab wounds. The admitted patients spent an average of two days in the hospital.

Mild rhabdomyolysis and myoglobinuria occurred in 1% of patients and required hospital treatment. No renal complications were seen. Whether the breakdown of muscle occurred due to PCP abuse<sup>2,3</sup> or to the tetanic contractions associated with the Taser® could not be determined, but each of these patients had positive levels of PCP. One patient developed a testicular torsion immediately after being "tasered." He denied preexisting scrotal pain or swelling, but it could not be determined whether the torsion was a result of the Taser® wound. This patient was "tasered" for criminal activity and not for psychiatric or drug-related behavior. His PCP screen was negative.

One patient stated that he became sterile after being "tasered" in the scrotum. Whether the sterility was preexisting could not be determined (Table 2).

**Disposition**

"Tasered" patients spent an average of 6.5 hours (SD, 4.3) in the ED. The disposition of patients after treatment in the ED is shown (Figure 3). Sixty-two percent of patients had a psychiatric evaluation while in the ED. Half of these (66 patients) were admitted to the hospital psychiatric unit on a 72-hour involuntary hold. These patients spent an average of four days in the facility before being released. Almost half of all patients were lucid enough to be discharged.

**Other Observations**

A lucid interval was reported by the police in 3% of patients. While the previously psychotic patients had current flowing through their bodies, they apparently became lucid and oriented, only to later revert to disoriented and violent behavior. This was strictly a lay observation and was not confirmed by medical or psychiatric personnel. Ninety-two percent of pa-

**TABLE 1. Reason for patients being "tasered"**

Reason	% of Patients
Bizarre and uncontrollable behavior	76
Bizarre and extremely combative behavior	40
Criminal activity, not intoxicated	7
<b>Clinical Correlation</b>	
Phencyclidine abuse — by history or drug screen	86
Ethanol intoxication — by history and serum levels	26
Cocaine intoxication	4

**TABLE 2. Complications of Taser® use**

Complication	% of Patients
Contusions, abrasions, lacerations (probably preexistent and related to phencyclidine abuse)	38
Mild rhabdomyolysis (probably related to phencyclidine-induced hyperactivity)	1
Testicular torsion	0.5
Sterility in men (not proven)	0.5
Mortality	1.5

patients stated that they had total amnesia for the event and didn't remember being "tasered."

**Wound Care**

Wound care follow up was very poor. None returned for wound check clinic appointments. All patients were telephoned for follow up, but only 15% could be reached. The 48% of patients who were admitted to either the medical or psychiatric hospital were watched an average of four days and

had no wound infections. The 2- to 4-mm wounds were not sutured, but were cleaned with Betadine® solution and dressed. All healed satisfactorily.

**Patients Shot With .38 Specials**

Data were collected on 22 patients brought by paramedics for treatment after being shot by police with .38 Special handguns. The mean age of these patients was 18 years (range, 14 to 38) and all were men. The average number of bullet wounds was 1.1

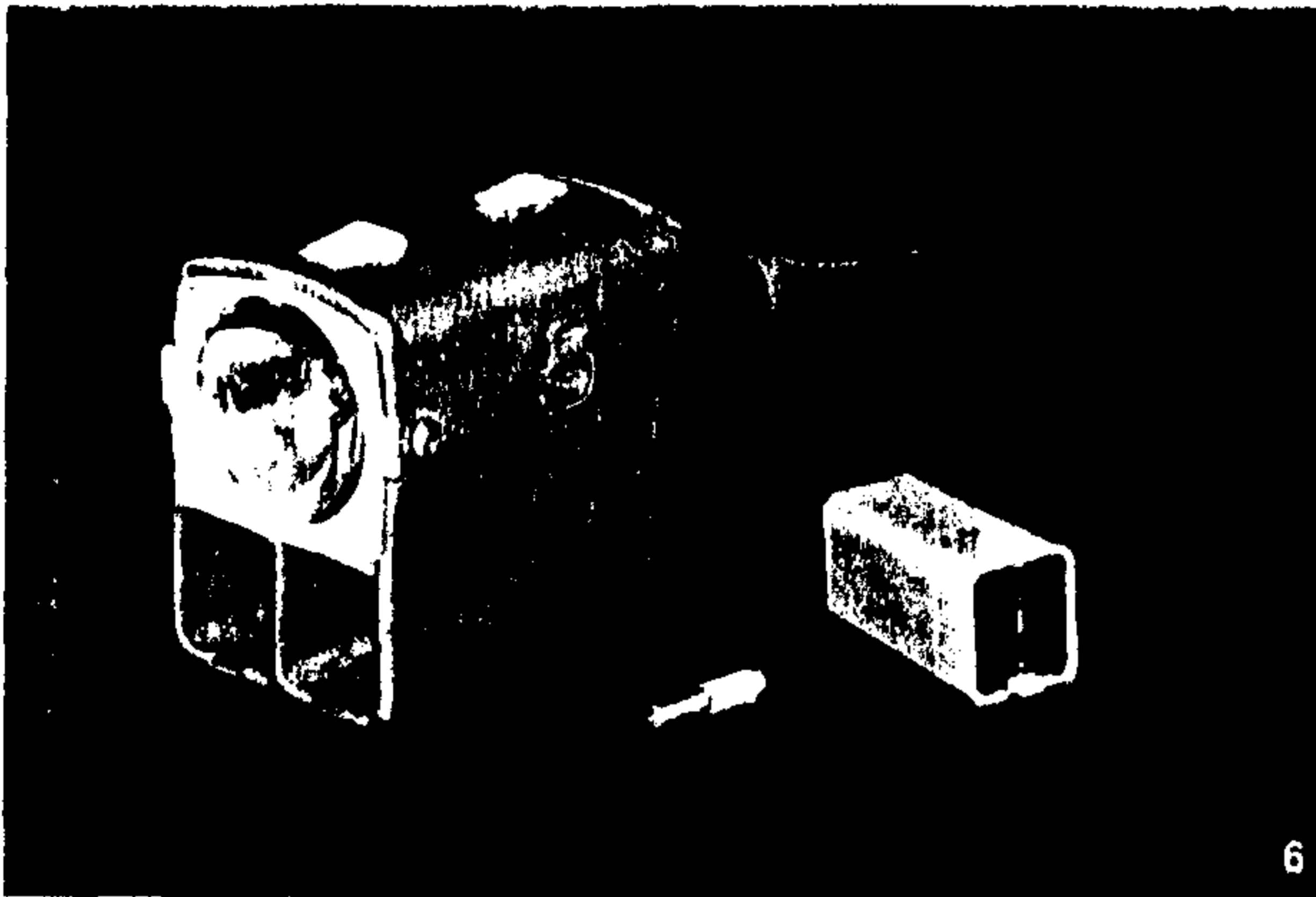


FIGURE 6. Taser® with cartridges.

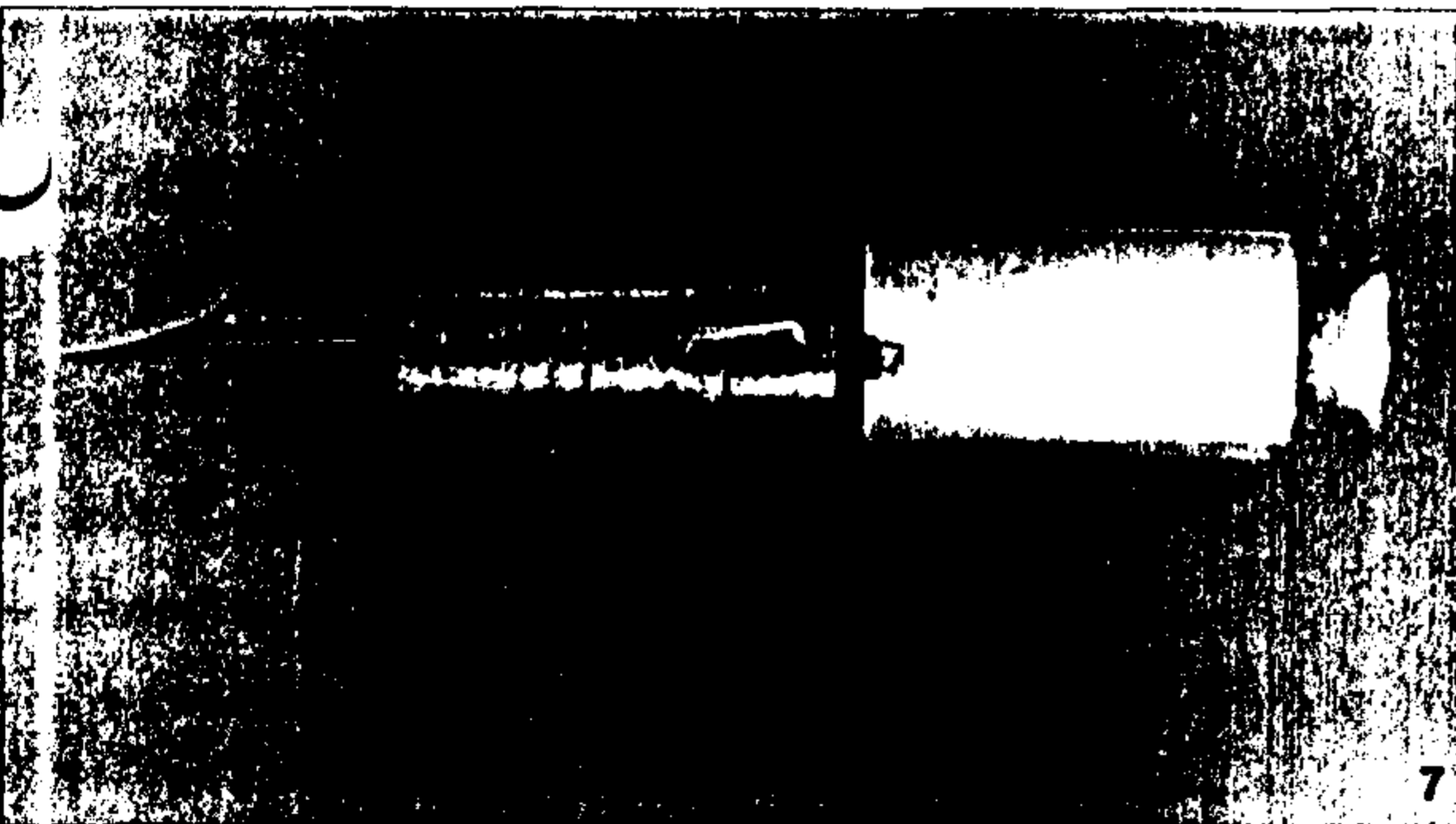


FIGURE 7. Taser® dart showing fish-hook-like barb at end of shaft.

(range 1 to 52). Twenty-five percent of the patients had physical or laboratory evidence of recent use of PCP, ethanol, or cocaine. The mortality rate was 50%; the 11 patients who survived suffered permanent morbidity, including paralysis, brain damage, and loss of limb. The operative rate was 82%, which included ED thoracotomy when the patient arrived *in extremis*. Average hospitalization for those patients who survived was 42 days (range, 12 to 160).

#### Comparison of Victims

There was a statistically significant difference ( $P < .01$ ) between the permanent morbidity rates of "tasered" patients (0%) and those shot by police with a .38 Special handgun (50%). There was also a statistically signifi-

cant difference ( $P < .01$ ) between the mortality rates of "tasered" patients (1.4%) and those shot by police with a .38 Special handgun who received treatment at the hospital (50%). Although the two groups (gunshot wound and "tasered" victims) are not equivalent, it would be impossible to establish a true comparison group in terms of location of injury, number of injuries, and reason for mechanical immobilization.

#### DISCUSSION

The Taser® is used by police to minimize the amount of force necessary to control violent suspects<sup>4</sup> (personal communications with Sgt Jim Kelly and Sgt Jack Schmida, Los Angeles Police Department, Personnel and Training Bureau, September 10, 1985). They

may be used when a lethal force, such as that from a .38 Special handgun, is not justifiable and when conventional tactics of verbalization, self-defense, firm grip control, and others do not subdue the suspect. The Taser® temporarily immobilizes by using electricity at 50,000 volts (0.8 joules [watt/seconds]).<sup>3</sup> This electricity is pulsed at a rate of 10 to 15 impulses per second and is sufficient to cause tetanic contraction of the body's muscles. Thus the suspect is involuntarily paralyzed as long as the current flows. When the Taser® release bar is depressed, two darts are propelled from the gun over a range of from two to 15 feet (Figures 4-6).<sup>4</sup> The darts (Figure 7) pull two fine conducting wires from a cassette. The darts can attach either to the suspect's clothing or to the skin. The current will effectively pass through two inches of clothing and need not penetrate the skin for immobilization.<sup>4</sup> A person who is "tasered" is immobilized with just two to three seconds of applied power.<sup>4</sup> The power may be repeated as required to maintain immobilization. Continuous application of current is not advised, for it could result in respiratory arrest. Tasers® have been shown to be effective in immobilizing suspects 82% of the time.<sup>4,9</sup> Recovery from being shot with a Taser® reportedly is rapid.<sup>4</sup>

#### Medical Treatment

The Taser® was designed as a non-lethal control device. Because the victim usually falls when paralyzed, many need medical treatment for minor trauma. Most are seen in the emergency department for removal of the darts from the skin.<sup>4</sup> The major problems requiring medical treatment appear to be from preexisting injuries and toxic conditions that actually led to the patient being "tasered." This was usually due to the toxic psychosis of PCP and to injuries sustained from the violent behavior associated with it. Although the hospital admission rate was high following Taser® wounds (48%), only one patient required admission because of a direct injury due to the Taser®. All other patients required admission for preexisting toxic psychoses, psychiatric disorders, and injuries associated with

violent behavior.

Three patients died, probably due to cardiac arrhythmia in a preexisting irritable heart.<sup>2,3</sup> All three patients who died sustained toxic levels of PCP; one had a history of cardiac disease and cardiac arrhythmias, and all died several minutes after being "tasered." Thus the Taser\* cannot be held solely responsible for their deaths. There is very little in the literature about mortality rates for phencyclidine abuse, but McCarron et al<sup>8</sup> showed a 0.1% mortality overall, with a 1% mortality rate (1/106 patients) for severely intoxicated patients (which our group represented), and a 5% mortality (1/20 patients) for severely comatose patients.

Other potential injuries not seen in this clinical study included penetration of major blood vessels,<sup>5</sup> rupture of the globe,<sup>5</sup> interference with a cardiac pacemaker,<sup>5</sup> electrically induced neurological and renal injury,<sup>9-12</sup> myocardial infarction,<sup>13,14</sup> cardiac arrhythmias,<sup>15</sup> and fractures.<sup>5</sup>

The incidence of rhabdomyolysis (1%) was consistent with, if not lower than, that in the literature (range, 0.2 to 11%).<sup>2,3,8,16,17</sup>

## CONCLUSION

When compared to police shootings with handguns to immobilize people with violent behavior, there is a marked and statistically lower mor-

tality and morbidity rate when the Taser\* is used. Another way of viewing these data is to say that the Taser\* was associated with a 1.4% mortality rate, and probably saved the 48.6% of patients who may have otherwise been shot with a .38 Special handgun.

The authors thank Sgt Jack Schmida and Sgt Jim Kelly of the Los Angeles Police Department for information and reference sources on the Taser\*; Los Angeles Police Department Chief Darryl Gates for his reference on the police use of the Taser\*; Officer Billy Holland for posing for photographs and use of his Taser\* for this study; and Cindy Ordog for editing and typing the manuscript.

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