

## Managing Law Enforcement (K-9) Dog Bites in the Emergency Department

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### ■ ABSTRACT

**Objective:** To review the types of injuries due to law enforcement (K-9) dog bites and address related management issues.

**Methods:** A case series of law enforcement dog bite victims is reported and related literature reviewed.

**Results:** Law enforcement dogs are taught a bite-and-hold technique for subduing individuals suspected of felony crimes. This bite-and-hold technique's greater applied force results in a unique spectrum of injuries, including deep puncture wounds, severe crush injuries, large tissue avulsions and lacerations, wounds necessitating surgical débridement, bony injuries ranging from cortical violations to displaced fractures, neurovascular damage, and other wounds at high risk for infection. The four reported cases highlight the types of injuries and complications associated with law enforcement dog bites.

**Conclusion:** Attention to potential deep injuries of nerves, vessels, and the musculoskeletal system is essential with law enforcement dog bites. Injuries associated both with pursuit and arrest and with the bites themselves must be identified and assessed. Guidelines for the ED treatment of patients with law enforcement dog bite injuries are proposed.

**Key words:** injury; bite wound; dog; canine; therapeutics.

*Acad. Emerg. Med.* 1996; 3:352-358.

*"This is the Los Angeles police. A police dog is going to be used to find you. If you surrender now, the dog will not be used. You have 1 minute to surrender."*

Los Angeles Police Department, 1992<sup>1</sup>

■ Throughout the United States, there are approximately 2,000 law enforcement (K-9) dog units consisting of approximately 7,000 canine-handler teams.<sup>2</sup> The German shepherd is the preferred breed of dog by police

officers due to its intelligence, keen sense of smell, and temperament,<sup>3</sup> although rottweilers and Doberman pinschers also are used.<sup>2</sup> Law enforcement dogs are used for crowd control, to find missing persons, to direct searches for illegal contraband, and to sniff out explosive devices.<sup>3-5</sup> However, the primary function of police dogs is to locate and assist in the apprehension and arrest of individuals suspected of felony crimes.<sup>4</sup> According to law enforcement, the use of police dogs makes searches for suspected felons safer, faster, and more successful.<sup>4</sup> The Los Angeles Police Department alone conducts approximately 1,500 K-9 searches per year.<sup>4</sup>

Law enforcement dogs track using their sense of smell, which is 6 million times keener than that of humans.<sup>6</sup> These dogs are trained to locate a suspected felon by smelling "rafts" of dead skin cells and "fear scent" from the suspected perpetrator.<sup>4,7</sup> This enables them to locate the suspected felon, and warn law enforcement officers even before the suspected felon is visible.

Unlike civilian dogs, the majority of police dogs are trained to use a bite-and-hold technique to apprehend a suspected felon.<sup>8</sup> The suspected felon commonly struggles to avoid arrest, pain, and injury, prompting the dog to regrasp and hold with greater force. Law enforcement dogs are trained to exert bite forces as great as 500-800

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*Received: June 5, 1995; revision received: September 12, 1995; accepted: September 23, 1995; updated: November 1, 1995.*

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psi,<sup>9</sup> compared with 200–400 psi for a civilian dog.<sup>10</sup> These greater bite forces, in association with the police dog's bite-and-hold technique, result in severe injury not frequently seen with civilian dog bites. These injuries include deep puncture wounds, severe crush injuries, large tissue avulsions and lacerations, wounds necessitating surgical débridement, bony injury ranging from cortical violations to displaced fractures, neurovascular damage, and wounds at high risk for infection. The law enforcement dog's trained bite-and-hold technique also increases the duration of the dog's snorting (breathing) into the wound as well as the duration of the wound's exposure to the animal's oral flora. Therefore, a higher risk of bacterial contamination leading to wound infection may exist with law enforcement dog bites than with civilian dog bites. Clearly, patients presenting to the ED with law enforcement dog bites present with a unique spectrum of canine injuries.

Professionally trained guard dogs are now being used not only by law enforcement agencies but also by the U.S. National Parks Service, rapid transit systems, universities, medical schools,<sup>2</sup> and even hospitals.<sup>11</sup> With the projected increase in the number of canine training facilities and trained guard dogs in the United States,<sup>2</sup> emergency physicians (EPs) may increasingly be confronted with this unique spectrum of canine injuries. Scant information is available in the medical literature about the patterns of injury and the management of law enforcement dog bites. We report four cases to exemplify the types and severity of law enforcement dog bite injuries, and emphasize the ED management of these injuries.

### ■ CASE 1

An 18-year-old male, a suspected felon, was brought to the ED by law enforcement officers after being bitten on the throat while being apprehended by a police dog. The patient reported a brief episode of loss of consciousness while being held at the throat by the dog but awakened when released from the dog's grasp. The patient denied respiratory distress but complained of hoarseness.

On physical examination the patient was anxious, with normal vital signs. The anterior neck had a 1-cm laceration, and a 3-mm puncture wound that bubbled and blew air when the patient vocalized. There also was a 1-cm laceration over the left sternocleidomastoid muscle. Oropharyngeal examination was unremarkable, as was the remainder of the physical examination.

The result of pulse oximetry on room air was 94%, and hematocrit (Hct) was 41%. Radiographs of the neck revealed air in the soft tissue. The chest radiograph was normal. The ear, nose, and throat (ENT) surgery service

was consulted, and fiberoptic laryngoscopy revealed a laryngeal perforation with paralysis of the left vocal cord. Neck CT ruled out a laryngeal fracture. A tetanus (Td) booster was administered, and all wounds were managed by irrigation with normal saline and sterile dressing changes without suturing. The patient was hospitalized and treated with IV dexamethasone for two days and IV antibiotics for five days. He was discharged to the County Jail Infirmary with the diagnosis of laryngeal perforation with left vocal cord paralysis due to injury to the recurrent laryngeal nerve, secondary to a law enforcement (K-9) dog bite.

### ■ CASE 2

A 29-year-old male, a suspected felon, presented to the ED after being bitten on the right upper extremity and both lower extremities by a police dog during his apprehension and arrest. Examination of the right lower extremity revealed three lacerations 5 to 6 cm in length extending medially from 2 cm distal to the anterior tibial tuberosity toward the posterior aspect of the lower leg, with exposed bone. The right upper and left lower extremities had multiple minor lacerations and numerous puncture wounds. The extremities were neurovascularly intact, and the rest of the physical examination was normal.

Radiographs revealed soft-tissue swelling of the extremities with a comminuted transverse fracture of the right distal ulna and a cortical violation of the right tibia. Angiography of both the right upper and lower extremities was normal. IV antibiotics were given and orthopedic surgery took the patient to the operating room (OR) for wound irrigation, débridement, and closure of the tibial periosteum. All wounds were left open to heal by secondary intention. The ulnar and tibial fractures were managed with sterile dressings and splinting.

Ten days later the patient had a second intraoperative débridement of the right lower extremity. Sixteen days post injury the patient underwent split-thickness skin grafting of the right lower extremity. Eighteen days post injury the patient was transferred to the County Jail Infirmary for further wound care. His discharge diagnoses were open right ulnar fracture, right tibial cortical violation, and large right lower-extremity tissue avulsion secondary to law enforcement (K-9) dog bites.

### ■ CASE 3

A 38-year-old male, a suspected felon, was brought to the ED by law enforcement officers after being bitten on both upper extremities and the right lower extremity by a police dog during his arrest. Examination revealed a 10-cm laceration on the lateral aspect of the distal third

of his right upper arm. There also were six puncture wounds medially on the right upper arm. The right brachial and radial pulses were diminished. The left upper and right lower extremities had multiple puncture wounds, without evidence of vascular injury. Neurologic examination was normal in all extremities, as was the remainder of the physical examination.

Radiographs of the right humerus and elbow showed marked soft-tissue swelling and subcutaneous air, without joint or bony abnormalities. Doppler study of the left upper extremity was normal but there was markedly diminished arterial flow in the right upper extremity. The vascular surgery service was consulted and the patient was taken immediately to the OR. The damaged right brachial artery segment was excised and replaced with a saphenous graft. The other wounds were irrigated with normal saline and received sterile dressings. The patient was hospitalized and received five days of IV antibiotics. He was discharged to the County Jail Infirmery nine days post injury with the diagnosis of right brachial artery laceration secondary to law enforcement (K-9) dog bites.

#### ■ CASE 4

A 23-year-old male, a suspected felon, was brought to the ED by paramedics in the company of law enforcement officers. He had been involved in a shoot-out with police officers following a car chase and motor vehicle crash (MVC). He sustained a superficial gunshot wound to the scalp, and a gunshot wound to the right ear. He also sustained multiple police dog bites to the upper extremities during his arrest. He was lethargic and complained of pain at the locations of the police dog bite wounds.

Although the patient was initially hypotensive in the field with a systolic blood pressure of 78 by palpation, he responded to a crystalloid challenge, and ED vital signs were normal. Physical examination revealed a 3-cm laceration from a tangential gunshot wound to the right parietal area without obvious intracranial penetration and a through-and-through gunshot wound to the pinna of the right ear. The left shoulder and upper arm had multiple puncture wounds involving the deltoid muscle and axilla. The right forearm, wrist, and hand had multiple puncture wounds. There also were four 1-cm lacerations over the thenar eminence and the first metacarpal joint. Neurovascular examination of both upper extremities was normal.

The patient's Hct was 39% and remained stable. Radiographs of the right wrist and hand revealed nondisplaced scaphoid and triquetrum fractures at the site of the police dog bites. Radiographs of the left shoulder and CT of the head were normal. All wounds were ir-

rigated with a normal saline/povidone-iodine solution, followed by a washout with normal saline alone. The scalp laceration was sutured. The patient was given a Td booster and started on IV antibiotics.

The neurosurgery, vascular surgery, ENT, and orthopedic surgery services were consulted. Angiography of the left axillary and brachial arteries was normal, and the hand and wrist received sterile dressings and were splinted. The ENT service repaired the gunshot wound to the right ear. After hospitalization and three days of IV antibiotics, the patient was discharged to the County Jail Infirmery. Discharge diagnoses were open fractures of the right scaphoid and triquetrum, multiple puncture wounds and lacerations secondary to law enforcement dog bites, a tangential gunshot wound to the scalp, and a through-and-through gunshot wound to the right ear.

#### ■ DISCUSSION

The above cases exemplify the types and extent of injuries and complications that may occur with law enforcement (K-9) dog bites. These include multiple puncture wounds, deep lacerations and tissue avulsions, neurovascular injuries, and bony injuries ranging from cortical violations to displaced fractures. These patients also may have injuries associated with their pursuit and arrest that are unrelated to the police dog bites. This presentation is illustrated by case 4, in which the patient sustained a tangential gunshot wound to the head and a gunshot wound to the ear, in addition to having been involved in an MVC.

Patients with police dog bite injuries while in the custody of law enforcement are usually taken to the ED for evaluation and management of their injuries. The number of patients presenting to EDs with law enforcement dog bite injuries is unknown. However, in one large study, a level I trauma center averaged more than 150 cases per year.<sup>12</sup>

Despite a substantial presence of law enforcement dogs and dog bite injuries, the majority of EPs have little or no experience managing the spectrum of injuries associated with law enforcement dog bites. Guidelines on managing law enforcement dog bite injuries have not previously been proposed. We suggest the following guidelines for managing law enforcement dog bites in the ED.

#### ■ PROPOSED MANAGEMENT GUIDELINES

##### Out-of-hospital Care

Before rendering aid to a suspected felon who has sustained law enforcement dog bites, paramedics and

emergency medical technicians should be assured of their own safety, be convinced that the patient and environment are safe to approach, and ensure the law enforcement dog is secured. Out-of-hospital providers must approach the patient with an appreciation of the risk of severe injury from a law enforcement dog bite, as well as the possibility of associated injuries unrelated to the dog bite.

### **ED: Initial Evaluation and History**

In the ED, attention must be paid to bite wounds of the neck and thorax, which may compromise airway, breathing, and circulation. Vital signs and pulse oximetry should be monitored, and IV access should be established when indicated. Following the primary survey, a complete secondary survey should follow, to evaluate for injuries that are not immediately life-threatening or apparent. As part of the secondary survey, distal pulses should be evaluated in all bitten extremities to assess for possible arterial injury.

A thorough history should be obtained in these cases, from both the patient and the arresting law enforcement officers. Patients may reveal significant facts related to their injuries, unknown or inadvertently omitted by law enforcement officers. For example, the patient may describe a pursuit that includes injuries sustained in an MVC, a fall from a significant height, blunt head and facial trauma from a flashlight or club, or a toxic exposure from hiding in a dangerous environment. Further, the patient may admit to being under the influence of alcohol or drugs. The history from law enforcement officers may reveal evidence of drug ingestion by the suspected felon immediately prior to arrest, i.e., swallowing large amounts of crack cocaine, phencyclidine (PCP), amphetamines, or lysergic acid diethylamide (LSD). Also, law enforcement officers may reveal the patient's potential for violence, as well as the officers' perspectives on how the patient's injuries were sustained. These two histories will help clarify all possible mechanisms of injury and complications from the pursuit, the apprehension, and the arrest.

All dog bite wounds should be carefully and schematically documented in the medical record. Special attention should be paid to location, size, configuration (laceration vs puncture), and depth of each wound. The number of wounds should not be confused with the number of bites, as a single bite may produce multiple puncture wounds and lacerations from the dog's individual teeth. Whenever possible, a color photograph of all law enforcement dog bite wounds should be taken as part of the medical record.

Injuries from law enforcement dog bites should be clearly delineated from other injuries not associated with

the dog bite, and explicitly documented as such in the medical record. The deployment of a police dog constitutes a use of force by law enforcement officers, and increases their potential for criminal and civil liability.<sup>13,14</sup> Therefore, EPs should be well aware that the medical record may be reviewed by legal representatives of the suspected felon and by the district attorney's office. EPs may be required to testify in court.

### **Irrigation and Débridement**

The majority of law enforcement dog bite injuries involve soft tissues of the extremities. Due to the predominance of massive tissue injury, these wounds should be managed more aggressively than most civilian dog bites. All wounds, especially medium and large lacerations ( $\geq 5$  cm) and gaping wounds, should be copiously irrigated without delay in the ED. Pressure irrigation of dog bite wounds has been recognized as an important deterrent to wound infection, decreasing the infection rate fivefold.<sup>15</sup> Wound irrigation should consist of an initial 2-L washout with a 1% povidone-iodine/normal saline solution.<sup>16</sup> This should be followed by an additional 2-L washout with normal saline alone<sup>16</sup> to prevent toxic effects from prolonged tissue exposure to povidone-iodine. Puncture wounds and small lacerations should be irrigated as well as possible. Following irrigation, thorough wound débridement of all nonviable nonvital tissue is essential. Wound débridement, like irrigation, markedly decreases the wound infection rate.<sup>17</sup>

### **Wound Closure**

Gaping wounds should be loosely approximated to preserve tissue for cosmetic and functional purposes. Large partial tissue avulsions and near amputations of extremities should initially have bleeding controlled. Partially avulsed tissues should then be covered with normal-saline-soaked dressings, to preserve tissue viability until surgical consultation is obtained. Scalp wounds may be closed primarily after careful inspection for galea or cortical violation. Hand wounds should not be primarily closed in the ED, as they commonly become infected.<sup>18</sup> Puncture wounds should be left open. Many law enforcement dog bite wounds are heavily contaminated. These wounds may be treated with delayed primary closure after the patient has received several days of IV antibiotics and appropriate wound care, and there is no sign of wound infection.<sup>19</sup>

### **Antibiotics**

The use of prophylactic antibiotics for civilian dog bites remains controversial.<sup>10,20</sup> There is no study addressing this issue with regard to law enforcement dog

bites. However, the use of prophylactic antibiotics is recommended for civilian dog bites that are at high risk for infection. Such high-risk wounds include full-thickness puncture wounds, severe crush injuries, wounds that necessitate surgical débridement, wounds with bone, joint, tendon, or ligament involvement, and wounds involving the hands, foot, or face.<sup>21</sup> Most law enforcement dog bite injuries will include a high-risk wound. Furthermore, the extent of tissue damage and the prolonged exposure to the dog's oral flora increase the risk of bacterial wound infection compared with most civilian dog bites. We therefore recommend IV antibiotics and hospitalization for all but the most minor dog bite injuries.

The bacteriology of civilian dog bite injuries has been intensely researched, and infections are frequently polymicrobial.<sup>10</sup> However, the choice of antibiotics remains controversial.<sup>22</sup> The bacteriology of law enforcement dog bites is most likely similar to that of civilian dog bites. The prophylactic antibiotic chosen should be active against the aerobic and anaerobic normal oral flora of the animal, the skin flora of the victim, and likely environmental contaminants.<sup>23</sup> The majority of patients with law enforcement dog bites do not present to the ED with clinical signs of wound infection. Those who do should have the wound cultured and be hospitalized for IV antibiotics against the most frequently isolated organisms in dog bite wounds (*Pasteurella multocida*, *Staphylococcus aureus*, streptococcal species, and gram-negative and anaerobic organisms).<sup>24</sup>

Tetanus immunization status should be verified, and Td prophylaxis should be administered as indicated.<sup>25</sup> Patients with law enforcement dog bites are not considered at risk for rabies.

### Facial and Neck Wounds

The evaluation of facial wounds should focus on the integrity of structures such as the eyes, the lacrimal and parotid glands, and the sinuses. Avulsed tissues from the cheeks, nose, and ears should be properly preserved.<sup>26</sup> The site of an avulsion injury should be covered with sterile dressings soaked in normal saline.

Law enforcement dog bites to the neck may be fatal.<sup>8,13</sup> Therefore, neck wounds necessitate careful evaluation, with special attention to injuries involving all zones of the neck due to the location of vital structures in these areas. Patients with neck injuries are at risk for multiple complications, including major vascular injuries, laryngeal and esophageal injuries, upper airway obstruction, pneumothoraxes, and air emboli.

### Diagnostic Studies

Radiographic studies should be obtained as indicated by location of injuries and physical findings. Neck in-

juries may necessitate extensive evaluation, which may include fiberoptic laryngoscopy, contrast studies of the esophagus, and angiography of the carotid and vertebral artery systems. Thoracic wounds, especially those with subcutaneous air, should prompt radiographic evaluation of the chest to rule out a pneumothorax.<sup>27</sup> EPs should have a higher index of suspicion for vascular injuries than with civilian dog bites due to greater shearing and crushing forces with law enforcement dog bites. Approximately 7% of law enforcement dog bite injuries necessitate vascular studies, compared with <0.05% of civilian dog bites.<sup>12</sup> Angiography is indicated for patients with pulse deficits, expanding hematomas, bites in proximity to vascular structures, or abnormal Doppler studies. Among patients with police dog bites to the extremities, positive angiograms have been found for approximately 25% of those with suspected arterial injuries.<sup>12</sup> A saline or methylene blue arthrogram should be obtained to rule out a penetrating joint injury.<sup>28</sup> Compartmental pressures should be measured if a compartment syndrome is suspected.<sup>29</sup>

### Cortical Violations and Displaced Fractures

Patients in cases 2 and 4 suffered cortical violations and displaced fractures directly related to the police dog bites. Bony injuries are not rare in law enforcement dog bite wounds, and have been found to occur as frequently as 4% of law enforcement dog bite cases evaluated in our ED.<sup>30</sup> These injuries should be considered open fractures with a high risk for infection. Patients should promptly receive IV antibiotics in the ED. Puncture wounds to the head may necessitate CT to rule out cortical violation and intracranial penetration.

### Penetrating Joint Injuries and Compartment Syndrome

Law enforcement dog bites in proximity to any joint should be evaluated for the possibility of a penetrating joint injury. If an open joint is suspected, plain radiographs are indicated to evaluate for intraarticular air, and cortical violation or fracture in the vicinity of the joint. If open joint is not evident on the radiographs and an open joint injury is still suspected, a saline or methylene blue arthrogram should be obtained.<sup>28</sup> If any of these diagnostic studies are found to be positive for a penetrating joint injury, the patient should be started immediately on IV antibiotics. An orthopedic surgery consultation should be requested for possible intraoperative irrigation of the involved joint.

The diagnosis of a compartment syndrome should be entertained, particularly with law enforcement dog bites to the lower extremities. If a compartment syndrome is suspected compartment pressures should be measured,<sup>29</sup>

and if they are elevated, prompt measures to lower compartment pressure should be taken with appropriate consultation, when available.

### Specialty Consultation and Interfacility Transfer

Victims of law enforcement dog bites may present to community hospitals for initial evaluation and treatment. Following ED evaluation, stabilization, and initial management, a stable patient requiring admission may be transferred to a hospital that provides inpatient care to in-custody patients.

Some patients may require specialty services and consultation prior to transfer. If specialty consultation services are not available in the community hospital, the patient should be transferred to the nearest medical facility with the necessary services. Consultation is indicated for specific and severe injuries. Bite lacerations to the face involving the nose, ears, vermilion borders of the lips, and salivary glands should be referred to plastic or ENT consultants for possible primary wound closure. Suspected eye injuries involving the globe, lids, or lacrimal glands necessitate ophthalmologic consultation.

Injuries involving cortical violations and fractures should be managed in consultation with an orthopedic surgeon, who may intraoperatively irrigate and débride the wound and close the periosteum, as occurred in case 2. Extremity injuries with large soft-tissue defects, including near and complete amputations, necessitate early reconstructive surgical and orthopedic consultations. Intraoperative irrigation, débridement, diagnostic studies, reimplantation, and neurovascular reconstruction may be required.

### The In-custody Patient

In association with their law enforcement dog bite injuries, a number of these patients may be under the influence of drugs such as alcohol, PCP, amphetamines, or cocaine. Appropriate drug screens should be requested, and drug-related medical complications suspected (i.e., withdrawal, rhabdomyolysis, intracranial bleeding, seizures, myocardial infarction). In addition, the risk of medical illnesses may be higher for some in-custody patients having societal factors and habits such as smoking, alcohol abuse, illicit drug use, and poor medical compliance. The in-custody patient also may differ from other patients in attitude and cooperation with medical care. Clearly, the potential for violent behavior is greater when the patient is intoxicated or angry with the circumstances of his or her apprehension and arrest. Chemical as well as additional physical restraints may be indicated.<sup>31</sup>

## CONCLUSIONS

Law enforcement dog bites lead to a unique spectrum of canine injuries. These injuries include deep puncture wounds, severe crush injuries, large tissue avulsions and lacerations, wounds necessitating surgical débridement, bony injuries, neurovascular damage, and other wounds at high risk for infection. Aggressive ED evaluation, stabilization, and management of these injuries by EPs are essential. Law enforcement dog bite wounds frequently necessitate extensive workup in consultation with specialty services. In addition to their having dog bite injuries, patients may be under the influence of alcohol or drugs and may have other injuries associated with their pursuit, apprehension, and arrest. The medicolegal implications of these types of injuries are significant. Research to further delineate the spectrum of these injuries and their medical cost is warranted.

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## *Reflections*

### ■ ANALYSIS OF OUR INTERVIEWS

#### Content

An introductory salutation and open hand  
 Precede the quest for what's critical and relevant:  
 "What brings you here today?" Another liberating demand,  
 "Tell me how you feel," is an efficacious abdicant.  
 Sequentially we seek, "How long have you felt this way?"  
 And, "What have you done to improve your condition?"  
 "Do family, other physicians know of what you've  
 conveyed?"  
 Or, "What are your expectations from my opinion?"  
 The paradise of succinct response is too often lessened  
 By some hidden agenda or misspoken revelation.

#### Subjects

Due to the complexity of their past histories  
 We've reviewed the Dean letter pamphleteers.  
 Within, biographies often note contention with adversity.  
 Supervisors laud the sufficiency of a student's character.  
 Clerkship directors translate their accomplishment to grades.  
 The weighted average leads to a quartile caricature.  
 Fourth-year E.D. audition reports are written to persuade.  
 NBME's above 200 cast a promise on their future.  
 The countenances are deceptive; with garlands removed  
 They're not all jewels-balanced, tempered and smooth.