CASE REPORT

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A Fatality and the American Mountain Lion: Bite Mark Analysis and Profile of the Offending Lion

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ABSTRACT: Attacks on humans by mountain lions have been infrequent in the history of the United States. Of the 64 authenticated attacks since 1890 in North America, there have been 13 fatalities. This paper reports a case of an adult mountain lion which attacked and killed a female jogger during the spring of 1994 in California. The lion left an imprint of its teeth on the victim's chin. The authors used this bite mark to aid authorities in profiling the approximate age and gender of the attacking animal. The authors subsequently utilized bite mark analysis to establish that the lion actually responsible for the attack had been removed from the area.

KEYWORDS: pathology and biology, mountain lion, bite mark, fatality

The American lion (mountain lion, cougar, puma) is generally considered to be mystical and elusive, rarely seen by humans in the wild. These characteristics and the abundance of folklore have shrouded the cougar with mystique and much rumor. Native American mysticism abounds with stories of great magical and medicinal powers. The Cherokees considered *Klandaghi* the "lord of the forest." The Creeks said *Katalgar* was the "greatest of wild hunters." The Zuni of the Southwest called the cougar the "father of game" [*1*]. Indeed, millions of years of evolution have honed this predator into a formidable carnivore.

The mountain lion is an opportunistic hunter, preying on vulnerable and available animals. The mainstay of the cougar's diet is deer; however, many small wild animals and domestic animals are included in its diet [*1,2*]. Attacks on humans are seldom and fatalities are rare [*3*].

The earliest human fatality by a mountain lion in the United States was recorded in Chester County, Pennsylvania in 1751 [*4*]. From 1890 to 1990, 53 authenticated attacks on humans have been reported. These 53 attacks resulted in 10 deaths during this 100-year recording period [*1,5*]. Recently in 1991, with similarities to this case, an 18-year-old male was attacked and killed near Idaho Springs, Colorado, while jogging in a remote wilderness area [*6*]. Since December 31, 1990, there have been eleven additional attacks of which three were fatalities [*7*] (Table 1). Three of the thirteen fatalities have been in California; moreover, more people have been attacked since 1975 than over the entire previous century [*5*].

This is a case report of the first documented fatality involving a mountain lion in California in which the victim died as a direct traumatic result of the attack. A bite mark on the victim's chin was utilized to aid in "profiling" the estimated age and sex of the offending lion.

Case Report

On April 23, 1994, a 40-year-old caucasian female exited her vehicle during the early morning hours and began a cross-country run (one she had taken many times before) in the vicinity of the Auburn Lakes Recreational Area northeast of Sacramento. The area is located in the foothills of the Sierra Nevada mountain range. When she did not return home as expected, a search was begun and her body was located on April 24, 1994 at 0724 hours by another runner. The body was below the trail, off a steep embankment, prone and partially clothed. Soil and other debris covered the body, which had been partially, buried in the shade of the trees.

Initially, a crime scene investigation was conducted by the California Department of Justice as there was a suspicion of homicide. The California State Department of Fish and Game was notified when the facts suggested that a mountain lion may have been responsible for her death.

An autopsy was conducted on April 25, 1994, at the office of the Sacramento County Coroner. The body exhibited multiple lacerations, abrasions, contusions and two areas of avulsion. The injuries were both pre- and postmortem. The midface was missing. There were deep scalp lacerations and a single puncture into the skull was noted on the left occipital aspect of the calvarium (Fig. 1*a,b*). A pattern injury on the victim's chin appeared to be a bite registration (mark). Six incisors and a canine clearly registered as abrasions, with the second canine registering as a single perforation and subsequent laceration (Fig. 2). Extensive overlap of remaining injuries made evaluation of additional distinct patterns difficult. An injury on the lower right arm demonstrates a central contusion with radiating linear lacerations consistent with a cougar's paw print (Fig. 3). The thoracic contents were exposed posteriorly and portions of both lungs, spleen and left kidney were missing. The cause of death is listed as multiple traumatic injuries and exsanguination.

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TABLE 1—*Mountain lion attacks on humans since December 31, 1990.*[a]

Attacks	Location	Age/Sex
Fatal		
January 16, 1991	Idaho Springs, Colorado	18-year-old male
May 6, 1992	Kyuquot, Vancouver Island	8-year-old male
April 23, 1994	Cool, California	40-year-old female
Nonfatal		
July 3, 1991[b]	Lillooet, British Columbia	18-month-old female 2-year-old male Adult female
April 2, 1992	Gaviota State Park, California	9-year-old male
August 12, 1992	Glacier National Park, Montana	12-year-old boy
July 2, 1992	West Cracroft Island	29-year-old female
August 21, 1993[c]	Los Padres National Forest, California	6-year-old male
September 18, 1993	Cuyamaca State Park, California	10-year-old female
1993[d]	Wickenburg, Arizona	Adult female
May 9, 1994	Gold River, Vancouver Island	7-year-old male

[a]= No guarantee how comprehensive list is.
[b]= Cougar approached a group of school children on an outing near the Fraser River and started to lick one of the children. When the teacher attempted to intercede, cougar clawed or bit child, teacher and another child. Unknown if cougar was tracked and killed.
[c]= Some doubt as to the veracity of this report.
[d]= Incomplete information.
Source: Mountain Lion Foundation, P.O. Box 1896, Sacramento, CA 95812.

FIG. 1—*Extensive scalp lacerations; after removal of scalp hair* (A); *canine puncture into skull, left occipital area* (B).

FIG. 2—*Bite mark that registered on victim's chin.*

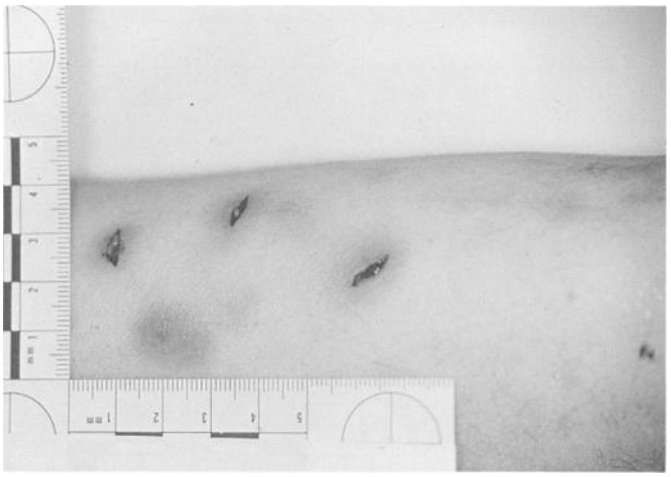

FIG. 3—*Victim's right lower arm; paw print with contusion.*

Multiple photographs were taken of the bite mark on the chin. Three cameras were used with various exposures. The ABFO No. 2 scale was used as a reference. Photographs were adjusted to life-size (1:1). Similar photographs were also taken of the puncture in the skull which had a diameter of 3 mm and was felt to have been caused by a canine.

Eight days of intensive tracking took place in the area around the kill site. Only two lions were located and tracked during this period, one being a large male. The second, a female, was dispatched on May 1, 1994, at 0848 hours approximately 400 meters from the kill site. A preliminary oral examination of this animal at Region II headquarters of the Department of Fish and Game, demonstrated nothing to exclude it from consideration. A multidisciplinary forensic team was notified and a full necroscopy was conducted at the California Veterinary Diagnostic Laboratory Systems. The necroscopy demonstrated a healthy lactating 3-year-old female mountain lion in good physical condition. Toxicology studies to include heavy metals and organochlorines were negative. Rabies fluroescent antibody was also negative. The remainder of the necroscopy was essentially unremarkable.

Discussion

In the interval between the attack and the taking of the female cougar, several factors were considered concerning mountain lions. Were there individual odontologic differences between lions which could be demonstrated and, if so, to what degree? The authors examined measurements recorded earlier on twelve mountain lions previously captured and released in California and also examined the skulls and mandibles of five adult cougars which were provided by the Department of Fish and Game. Individual characteristics and dimensional differences were noted (Table 2).

Mountain lions have a short, rounded skull with 14 lower teeth and 16 upper teeth. Due to their relatively short jaws and large temporalis and masseter muscles, they have a powerful bite, one that allows their proportionally large canine teeth to drive through their prey's muscle and bone. Between their maxillary and mandibular canines are six relatively small incisors (humans have four). The cougar's posterior teeth are called carnassials and are used to tear and shred rather than to chew [*8*]. Teeth are critical to the cougar's survival and the wide range of aberrations observed in human dentitions is not present. A malocclusion or functional abnormality that would interfere with feeding would result in the

TABLE 2—*Mountain lion data examined by authors.*

Sex	CR/Sk	Weight (kg)	Max inter-canine
M	CR	47.7	41.5 mm
M	CR	36.4	44.0 mm
M	CR	73.7	51.0 mm
M	Sk	38.7	45.0 mm
M	Sk	58.2	43.5 mm
M	Sk	not provided	48.5 mm
M	Sk	46.9	38.5 mm
M	Sk	56.0	44.0 mm
F	CR	38.6	40.5 mm
F	CR	36.4	40.0 mm
F	CR	36.4	41.5 mm
F	CR	40.5	38.5 mm
F	CR	38.6	40.0 mm
F	CR	46.4	35.0 mm
F	CR	36.4	37.0 mm
F	CR	41.0	43.0 mm
F	CR	38.6	37.5 mm

CR = Captured & Released Sk = Skull Max. = Maxillary
All of the above lions were determined to be mature adults. Actual ages unknown. Degree of maxillary canine wear not recorded on CR lions.

eventual demise of the lion. The upper permanent canines erupt at approximately eight months and can be utilized to estimate the animal's age by measuring the amount of incisal wear. The upper six incisors also show age-appropriate wear [*1*].

After comparing data from 17 mountain lions (12 captured/released and 5 skulls), some general conclusions were reached to aid in profiling the offending lion. The average maxillary intercanine measurements of the seventeen lions reveals a mean of 44.5 mm for the eight males and 39.2 mm for the nine females. Observations of the skulls verified the differences in incisal wear as consistent with the different ages of lions as shown in Fig. 4.

Following evaluation of the measurements of the bite mark on the victim's chin and the puncture into the calvarium, the authors concluded that the offending lion was probably an adult female; however, a young adult male could not be ruled out. It was concluded that an older lion with accentuated canine wear could not have made a 3 mm round puncture on the skull.

The mountain lion that was dispatched on May 1st was a 37.2 kilogram female with a maxillary intercanine width of 37 mm.

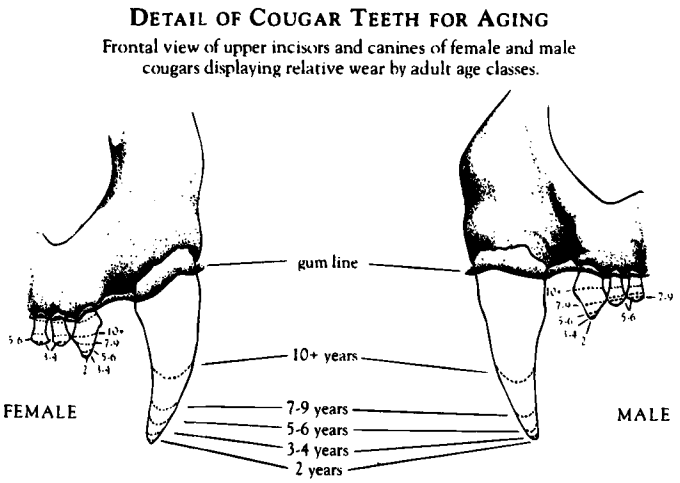

FIG. 4—*Incisal wear patterns used in aging.*
Source: Hansen, K., Cougar: The American Lion; 1994, p. 10.

The six maxillary incisors measured 20.0 mm. The bite mark on the victim's chin exhibited an intercanine distance of approximately 37–38 mm and the six maxillary incisors measured 20–21 mm. Superimposition of the clean, disarticulated skull of the cougar over the 1:1 photograph of the bite mark exhibits the correlating positions of the eight maxillary teeth which registered on the chin (Fig. 5). Following comparison of the female cougar's maxillary anterior teeth with the bite mark on the victim's chin, the authors concluded that it was highly probable the Department of Fish and Game had taken the correct mountain lion.

The author's conclusion was later confirmed by DNA comparison. Human DNA was found under the claws of the cougar which did match the victim. No human DNA was found in samples that were curetted from the gingival sulcus and interproximal embrasures of the lion [*10*]. The California Department of Fish and Game, Division of Forensic Investigations, correlated the DNA comparisons.

Summary

The California State Department of Fish and Game places the current California mountain lion population at 4000 to 6000 [*9*]. In the past 50 years, California has lost over 10 million acres of wildlife habitat [*10*]. The state's population is currently 32 million as of January 1994 [*11*]. All of the large metropolitan areas of California have adjacent cougar populations and about one-half of California is considered prime mountain lion country.

The potential for similar mountain lion attacks on humans continues to exist and may be on the increase. Indeed, more fatal attacks have occurred in the last 21 years than the previous 80 years [*1*]. The corollary between the 1991 Colorado case and the present California case might suggest that running or jogging during the peak activity periods of the lion could evoke a predatory response. This should always be considered in areas where the interactions between humans and lions is frequent or, perhaps, lessened innate fear of humans exists.

FIG. 5—*Superimposition of cougar skull over (1:1) size photo of the victim's chin.*

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