

Running Title: Fatal Leopard Attack: Autopsy Findings
**When Wilderness Strikes: Autopsy Findings in a Fatal Leopard
 Encounter – A Case Report**

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ABSTRACT

Human–wildlife conflict is escalating in India, with leopard attacks representing a subset of fatal encounters that pose distinct medicolegal challenges. We report the autopsy findings of a 32-year-old male daily worker at a tea estate in Ooty, Tamil Nadu, who sustained a fatal predatory leopard attack. External examination revealed a characteristic combination of deep, spindle-shaped canine puncture wounds over the neck bilaterally with inter-canine distances of 3.5–5.5 cm, an extensive avulsed scalp flap measuring 18.0 × 12.0 cm, parallel incised claw marks with inter-claw distances of 1.5–2.0 cm over the parieto-temporal region, and multiple linear scratch abrasions over the trunk and upper limbs. Internal examination disclosed irregular severance of the jugular and carotid vessels and fractures of the cervical vertebrae at the C2–C3 level. The provisional cause of death was determined as the combined effects of vascular injury and spinal cord injury consequent upon crush-force trauma to the left side of the neck. The injury pattern is consistent with an antemortem predatory leopard attack. Forensic evidence, including sterile swabs for animal DNA profiling and air-dried clothing, was preserved and submitted to the appropriate authorities. This case underscores the importance of systematic medicolegal autopsy in wildlife-related deaths and meticulous documentation of injury morphology to differentiate predatory attack from homicide and postmortem scavenging.

Keywords: Leopard attack; human–wildlife conflict; claw marks; medicolegal autopsy; cause of death

How to cite this article: Naveen C, Balaji Singh M, Prashanthi, Ravi Hosaholalu, Veeravijayan A. When Wilderness Strikes: Autopsy Findings in a Fatal Leopard Encounter – A Case Report. *Int J Drug Deliv Technol.* 2026;16(55s): 1333-1337. DOI: 10.25258/ijddt.16.55s.137

INTRODUCTION

Human–wildlife conflict has intensified in recent decades owing to progressive encroachment into forested habitats and the expansion of human settlements at the forest fringe. In India, the National Crime Records Bureau (NCRB) records approximately 1,500–1,800 deaths and injuries attributable to wildlife attacks annually, with a reported 15–20% rise in the post-COVID era ^[1]. Nationwide surveillance data indicate that elephants are the leading cause of wildlife-related deaths in India, while tiger attacks have accounted for more than 600 human deaths over the past decade. The Press Information Bureau of India estimates 80–120 wildlife-related deaths per year nationally, with elephants contributing the majority, followed by tigers, leopards, and bears ^[1]. States such as Kerala, Maharashtra, Odisha, West Bengal, Chhattisgarh, and Uttarakhand have experienced the highest burden of human casualties from wildlife encounters. Snake bite and rabies fatalities are excluded from these figures.

India harbours approximately 15 species of wild cats belonging to the family Felidae, ranging from large apex predators such as the Bengal tiger (*Panthera tigris tigris*), Indian leopard (*Panthera pardus fusca*), and Asiatic lion (*Panthera leo persica*) to smaller, more elusive species. Among these, the leopard is particularly relevant to human attacks because of its adaptability to peri-urban and agricultural landscapes and its tendency to inhabit areas close to human settlements.

Fatal attacks by large felids produce distinctive patterned injuries that carry significant medicolegal importance ^[2,3]. These include deep canine puncture wounds, parallel claw lacerations, and preferential targeting of the neck and head consistent with predatory kill behaviour. A fundamental forensic challenge in such cases is the differentiation of antemortem predatory injuries from postmortem scavenging, which requires systematic documentation of wound morphology, vital reactions, and scene correlation ^[2,3]. Proper medicolegal evaluation contributes to the

reconstruction of the fatal event, determination of cause and manner of death, and provision of evidence to wildlife and law-enforcement authorities for further action.

CASE REPORT

The body of a 32-year-old male daily wage worker employed at a tea estate was received at the mortuary of Government Medical College, The Nilgiris, Ooty, on 4 January 2025. The case was referred by the Inspector of Police, Manjoor Police Station, Ooty District, following a police inquest. As per the inquest report and eyewitness accounts, the deceased allegedly sustained a fatal encounter with a leopard while engaged in routine work at the estate. The body was recovered immediately after the attack and transferred to the mortuary without delay. Medicolegal autopsy was conducted in accordance with standard forensic protocols [2].

General Examination

The deceased was a moderately built and nourished adult male of light-brown complexion. The eyes were partially open; the conjunctivae were clear; the pupils were dilated and fixed. Post-mortem staining was faint and fixed over the dorsal surface of the body. The nail beds showed bluish discoloration. Dried bloodstains and mud particles were adherent over the right side of the face, forehead, and neck. Examination of the oral cavity revealed intact lips, gums, and tongue; dentition showed minimal attrition. Rigor mortis was well-established and appreciated throughout the body.

External Injuries

Injuries to the neck were the most prominent and lethal findings. On the left side of the neck, two spindle-shaped puncture/penetrating wounds were identified: one measuring 4.0×1.0 cm (muscle-deep) and another measuring 1.5×0.5 cm (muscle-deep), situated 5.5 cm apart, with clean-cut margins (Figure 1). On deeper dissection, the underlying jugular and carotid vessels were found to be severed irregularly. A second pair of puncture/penetrating wounds, measuring 2.0×0.8 cm and 1.0×0.6 cm respectively (both muscle-deep), was identified on the left side of the neck, situated 3.5 cm apart (Figure 2). Additionally, a puncture/penetrating wound measuring 1.0×0.5 cm (bone-deep) was noted at the back of the left ear, exhibiting a peculiar tailing pattern (Figure 3). The inter-canine distances of 5.5 cm and 3.5 cm recorded from these wound pairs are consistent with the dentition measurements reported for the Indian leopard in the published literature [3,6]. Injuries to the scalp and head were extensive. An avulsed lacerated injury was noted over the bilateral temporo-parieto-occipital region, with an avulsed flap measuring 18.0×12.0 cm and irregular margins (Figure 4). Over the left parieto-temporal region, two parallel incised wounds were identified: one measuring 4.0×1.0 cm (bone-deep) and another measuring 6.5×1.0 cm (bone-deep), with an inter-wound distance of 2.5 cm; both wounds intersected

anteriorly (Figure 5). Multiple irregularly placed, intersecting incised wounds ranging from 3.0×0.8 cm to 7.0×0.8 cm (cartilage-deep) were noted over the right ear (Figure 6).

On the upper limbs, four superficially placed incised wounds with a tailing pattern, ranging from 1.0×0.5 cm to 2.0×1.0 cm (muscle-deep), were noted over the outer aspect of the upper and middle thirds of the right arm (Figure 7). On the dorsum of the left hand, two parallel incised wounds measuring 2.0×1.0 cm and 2.0×1.5 cm (both subcutaneous-deep), with tailing towards the ulnar side and an inter-wound distance of 1.5 cm, were identified; three additional irregularly placed incised wounds measuring 2.0×1.5 cm, 2.0×1.0 cm, and 1.5×1.0 cm (subcutaneous-deep) were also present over the same region (Figure 8). Over the anterior aspect of the lower third of the left forearm, two puncture/penetrating wounds measuring 2.0×1.0 cm and 1.0×1.0 cm (muscle-deep), situated 5.0 cm apart, were noted (Figure 9).

Secondary impact injuries were noted over the trunk. On the left scapular region, two curvilinearly placed scratch abrasions, each measuring 6.0×0.5 cm, were identified. A scratch abrasion measuring 8.0×0.5 cm was noted over the lateral aspect of the right lower chest along the mid-axillary line. Multiple linear scratch abrasions ranging from 2.0×0.5 cm to 7.0×0.5 cm were noted over the middle of the back.

Internal Findings

Internal examination confirmed irregular severance of the jugular veins and carotid arteries bilaterally. Fractures of the cervical vertebrae were identified at the C2–C3 level. All abdominal viscera were intact and showed mild congestion on dissection. No injuries were identified in the thoracic or abdominal cavities beyond passive congestion.

Opinion on Cause and Manner of Death

Provisional Cause of Death: Death is due to the combined effects of spinal cord injury and vascular injury as a result of cervical vertebra fracture consequent upon crush-force injury to the left side of the neck.

Provisional Manner of Death: The injuries described are consistent with feline bite mark and claw mark injuries, based on the inter-canine distances (5.5 cm and 3.5 cm) and inter-claw distances (1.5–2.0 cm) [3,6]. The pattern of injuries—concentrated in and around the neck, with deep canine puncture wounds, parallel claw marks, avulsion of scalp, and evidence of dragging with vital reactions—is consistent with a feline prey-attack pattern. Among members of the family Felidae, the characteristic injury morphology is most consistent with an antemortem leopard attack. The history provided by the investigating officer and eyewitnesses corroborates the autopsy findings. The absence of homicidal indicators, the presence of vital reactions, the typical leopard kill

pattern, scene correlation, and the absence of evidence of staging collectively refute homicide [2,3].

DISCUSSION

This case illustrates the distinctive medicolegal features of a fatal predatory leopard attack and highlights the critical importance of systematic autopsy documentation in human-wildlife conflict deaths [2,6]. The injury constellation observed is consistent with the known predatory behaviour of the Indian leopard and permits reliable species-level attribution when corroborated by scene findings, eyewitness accounts, and supporting forensic evidence.

Injury Pattern Analysis

Canine puncture wounds—the spindle-shaped, deeply penetrating injuries over the neck seen in Figures 1, 2, and 3—are pathognomonic of large felid attack [2,3]. These wounds characteristically display clean-cut margins and depth disproportionate to their surface dimensions, owing to the narrowness and length of felid canines. Ketenci et al. [6], in a 10-year autopsy study of animal attack deaths, identified deep canine bite wounds to the neck as the dominant injury in fatal large felid encounters, a finding directly mirrored in the present case.

Claw-induced injuries, illustrated in Figures 4–8, manifest as multiple parallel linear incised wounds and abrasions produced by the sharp, retractile claws during gripping and subduing movements [3]. The inter-claw distances of 1.5–2.0 cm, the parallel orientation, and the characteristic tailing patterns are consistent with leopard claw morphology. Pathak et al. [3] similarly documented parallel claw marks as a hallmark of felid attack in their report of a fatal tiger assault, and the same morphological principles apply to leopard claw marks. The extensive avulsion of the temporo-parieto-occipital scalp (18.0 × 12.0 cm) reflects the tremendous gripping force applied during the attack and is consistent with the predator's effort to subdue and immobilise the victim.

The preferential targeting of the neck and head is characteristic of felid prey-attack behaviour. Leopards and tigers typically deliver a killing bite to the nape or throat of their prey, resulting in vascular injury, airway compromise, and cervical trauma [2,3]. The puncture wounds over the anterior aspect of the left forearm (Figure 9) and the superficial incised wounds over the right arm (Figure 7) are consistent with biting and shaking movements used by the predator to drag and reposition prey. The scratch abrasions over the scapular region, right lower chest, and back are consistent with secondary impact injuries from irregular vegetation at the scene of the encounter, rather than direct attack injuries [2].

Predatory versus Defensive Attack Patterns

A systematic distinction between predatory (prey) and defensive attack patterns in felids is of critical medicolegal importance [2,3]. Recognition of predatory patterns indicates hunting behaviour and

raises the possibility of a man-eater, whereas defensive patterns suggest provocation or incidental encounter. The injury distribution, wound morphology, and the victim's occupation in a forest-adjacent tea estate collectively support a predatory attack pattern in the present case. A detailed comparison of these attack patterns is presented in Table 1.

Table 1. Comparison of Predatory and Defensive Attack Patterns in Felids

Feature	Prey Attack Pattern	Defensive Attack Pattern
Purpose of attack	To subdue prey	Self-defence when threatened
Common species involved	Large felids (tiger, leopard)	Any member of Felidae family
Targeted body region	Neck, throat, head	Extremities (hands, legs, forearm)
Type of injuries	Deep canine puncture wounds, crush injuries, soft tissue tear	Multiple superficial scratches, abrasions, and small puncture wounds
Claw marks	Present but secondary to bite marks	Prominent parallel claw scratches due to swiping movements
Severity of injuries	Severe and fatal due to vascular or airway damage	Less severe; can lead to infection/bleeding
Injury distribution	Concentrated on vital areas	Scattered
Animal behaviour post-attack	May drag/carry victim and start scavenging	Retreats once threat subsides

Differential Diagnosis

The differential diagnosis for the injury pattern observed includes other wild animal attacks (hyena, wolf/dog, bear), domestic animal bites, postmortem animal scavenging, homicidal or assault injuries, mechanical or environmental injuries caused by machinery or fall upon sharp objects, and decomposition changes [4,5]. Bear attacks, as described by Bhat et al. [4] and Shah et al. [5], tend to produce predominantly facial, scalp, and upper limb

injuries from swiping movements, with a different wound morphology from the deep canine puncture wounds characteristic of felid attacks. The present injuries were distinguished from these alternatives by: the characteristic spindle-shaped canine puncture wounds with inter-canine distances specific to leopard dentition; parallel claw marks with species-consistent inter-claw distances; injury distribution concentrated on the neck consistent with a felid prey-attack pattern; presence of vital reactions confirming antemortem infliction; absence of homicidal indicators; and corroboration from the scene investigation and eyewitness accounts.

Leopard versus Tiger: Comparative Feeding Patterns

For the purpose of forensic completeness, the distinctive feeding and attack patterns of leopards and tigers are compared in Table 2 [2]. These differences can assist in species identification when scene evidence is available alongside autopsy findings, and may carry implications for wildlife management responses.

Table 2. Comparative Feeding Patterns: Leopard versus Tiger

Feature	Tiger	Leopard
Initial feeding site	Large muscular areas	Chest/neck
Carcass damage	Extensive, rough	Neater/localised
Bone involvement	Crushed bones common	Fine gnawing
Carcass location	Ground, hidden	Often tree-elevated
Feeding duration	Immediately starts eating; returns multiple times	Usually hides prey before eating; less consistent return
Scene disturbance	Large area disturbed	Relatively limited

Forensic and Medicolegal Significance

Recognition of predatory attack patterns during medicolegal autopsy is essential for several reasons [2,3,6]. First, it enables reliable differentiation of felid attack from homicide or other forms of violence, which has direct implications for the medico-legal investigation and the course of criminal proceedings. Second, it establishes the cause and manner of death on an objective evidential basis. Third, it assists wildlife and law-enforcement authorities in identifying a potential man-eater threat and initiating appropriate public safety measures, including relocation or culling of the offending animal where legally sanctioned. Fourth, it

contributes to the legal record in cases that may trigger compensation claims under the Wildlife (Protection) Act, 1972 and associated state policies. A man-eater is defined as a large carnivorous animal that has developed a behavioural pattern of habitually hunting and killing humans as prey. This behaviour in felids is associated with injury, old age, loss of natural prey, reduced natural habitat, or previous successful attacks on humans. Forensic recognition of man-eater behaviour carries significant public health implications and must be communicated promptly to wildlife authorities, as early intervention can prevent further loss of human life.

The preservation of sterile swabs for animal DNA profiling in these type of cases represents best practice in wildlife forensics [2]. Species-level confirmation of the attacking animal through DNA analysis provides objective scientific evidence in subsequent legal or administrative proceedings and reduces reliance on circumstantial evidence alone.

CONCLUSION

Fatal leopard attacks are rare but well-documented at human-wildlife interfaces, particularly in areas characterised by habitat encroachment, reduced natural prey density, and increased human activity at forest margins. The characteristic attack pattern—sudden stealthy ambush, preferential targeting of the neck and throat, dragging of the victim, and the distinctive combination of deep canine puncture wounds and parallel claw marks—permits reliable identification at medicolegal autopsy. Proper documentation of injury morphology, inter-canine and inter-claw measurements, vital reactions, and scene correlation is essential to differentiate predatory attack from homicide or other animal attacks, and to establish cause and manner of death. Forensic evidence preservation, including animal DNA profiling from wound swabs, further strengthens the medicolegal assessment. From a public safety perspective, forensic recognition of man-eater behaviour and timely communication to wildlife authorities is a critical function of the medicolegal autopsy in wildlife-conflict deaths. Awareness of these injury patterns among forensic pathologists, clinicians working at forest-fringe hospitals, and emergency first responders is strongly recommended.

DECLARATIONS

Conflict of Interest: None declared.

Funding: None.

Ethical Approval: The autopsy was conducted as a routine medicolegal procedure mandated by the police inquest. Patient identity has been anonymised in accordance with ethical practice. Written informed consent was not applicable as this is a medicolegal case report.

Acknowledgements: The authors sincerely thank Government Medical College, The Nilgiris, Ooty,

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for facilitating this case and the medicolegal autopsy proceedings.

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irregularly placed, intersecting incised wounds over the right ear.



Figure 3. Two parallel placed incised wounds of size measuring 2cm x 1cm x sub cutaneous deep to 2cm x 1.5 cm x sub cutaneous deep noted over back of left hand with tailing noted towards the ulnar side situated 1.5 cm apart. Three irregularly placed incised wounds of sizes measuring 2cm x 1.5 cm x sub cutaneous deep, 2cm x 1cm x sub cutaneous deep, 1.5 cm x 1 cm x sub cutaneous deep noted over back of left hand.

FIGURES:



wounds on the left side of the neck (2.0×0.8 cm and 1.0×0.6 cm), situated 3.5 cm apart. **Figure 1C.** Bone-deep puncture wound (1.0×0.5 cm) behind the left ear, exhibiting a peculiar tailing pattern.



irregular margins over the bilateral temporo-parieto-occipital region; **Figure 2B.** Two parallel incised (claw) wounds over the left parieto-temporal region, intersecting anteriorly; **Figure 2C.** Multiple