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Popular Article

Delayed-Presentation Polytrauma in a Free-Ranging Striped Hyena (*Hyaena hyaena*): Severe Open Distal Tibial Fracture, Suspected Thoracolumbar Spinal Cord Injury, and Septic Deterioration

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Abstract

This report describes the presentation, field-constrained management, and outcome of a free-ranging adult female striped hyena (*Hyaena hyaena*) admitted after an estimated >72-hour delay following traumatic injury. Clinical findings were consistent with a severe open distal tibial fracture (Gustilo–Anderson type III; provisional classification), suspected thoracolumbar spinal cord injury, and systemic inflammatory physiology with high suspicion of septic progression secondary to a contaminated wound. A four-day multimodal protocol was instituted, including intravenous isotonic crystalloid therapy, parenteral antimicrobials, sedation-assisted wound debridement and lavage, staged dressing changes, and limited fascial apposition to reduce dead space while maintaining drainage. Despite supportive care, neurological deficits persisted and the patient deteriorated to decompensated shock, with death on Day 5 post-admission. The case highlights how delayed rescue-to-care intervals and constrained diagnostics narrow the therapeutic window for limb salvage and neurotrauma management in free-ranging carnivores.

Keywords: wildlife trauma; striped hyena; *Hyaena hyaena*; open tibial fracture; Gustilo–Anderson classification; thoracolumbar spinal cord injury; decentralised triage; wound infection; sepsis; wildlife critical care; human–wildlife interface.

Introduction

The family *Hyaenidae* comprises four extant species: *Crocuta crocuta* (spotted hyena), *Hyaena brunnea* (brown hyena), *Proteles cristata* (aardwolf), and *Hyaena hyaena* (striped hyena). The striped hyena occurs across parts of Africa, the Middle East, and the Indian subcontinent, where it occupies arid and semi-arid habitats that increasingly interface with human-dominated landscapes. As a facultative scavenger with opportunistic feeding ecology, *H. hyaena* contributes to carrion removal and nutrient cycling, with potential downstream benefits for environmental hygiene and disease ecology.



Morphological adaptations in *H. hyaena* include robust jaw musculature, dentition suited to osteophagy, and relatively developed forequarter musculature that contributes to the species' characteristic sloping dorsal profile. Behaviourally, the species is primarily nocturnal, typically

Solitary during foraging, and uses anal gland secretions for territorial marking. Increasing spatial overlap with human settlements has been attributed to habitat fragmentation, reduced natural prey availability, and access to anthropogenic food resources. Recent work from Rajasthan also emphasises the species' functional role in anthropogenic landscapes, including carcass-removal ecosystem services and diet composition shaped by human food subsidies (Harihar et al., 2010; Panda et al., 2023a, 2023b).

Globally, *H. hyaena* is categorised as *Near Threatened* by the International Union for Conservation of Nature (International Union for Conservation of Nature, n.d.). In India, particularly across semi-arid regions such as Rajasthan, reported threats include road mortality, retaliatory killing associated with human-wildlife conflict, exposure to infectious agents, and expansion of linear infrastructure. Many morbidity and mortality events are likely under- documented due to limited reporting, carcass recovery, and diagnostic capacity. Vehicular collision is an important cause of morbidity and mortality in free-ranging striped hyenas and can result in polytrauma, haemorrhagic shock, spinal cord injury, and secondary wound infection. In parallel, striped hyenas may be exposed to infectious agents circulating at the domestic animal-wildlife interface (e.g., canine distemper virus, rabies virus, and vector-borne haemoparasites), which can complicate clinical management and biosafety. In many regions, limited surveillance and point-of-care diagnostics constrain rapid risk stratification and targeted therapy.

Despite their ecological relevance, striped hyenas are comparatively under-represented in region-specific clinical protocols and structured rescue infrastructure relative to some flagship carnivore species. This contributes to variable triage practices, inconsistent access to advanced imaging and laboratory support, and limited post-mortem data that could otherwise inform epidemiology and targeted mitigation.

Clinical case reports in wildlife medicine help operationalise evidence from individual events by documenting injury patterns, physiological derangements, interventions, and outcomes. When reported systematically, they can support refinement of field triage algorithms, highlight recurrent anthropogenic injury mechanisms, and identify gaps in diagnostics, therapeutics, and logistics relevant to conservation and public health. This report describes the clinical presentation, therapeutic management, and outcome of an



adult female *H. hyaena* rescued from the peri-urban periphery of Dungarpur, Rajasthan. The objective is to characterise a severe delayed-presentation polytrauma scenario and to outline pragmatic, resource-constrained interventions relevant to decentralised wildlife emergency care.

Case history and observations

On 21 February 2024, a free-ranging adult female striped hyena (*Hyaena hyaena*), estimated at ~3 years of age based on dentition and body condition, was admitted to the Teaching Veterinary Clinical Complex (TVCC), MB Veterinary College, Dungarpur, following rescue by the Rajasthan Forest Department. The animal was found laterally recumbent with markedly depressed mentation in a degraded forest-corridor periphery with substantial anthropogenic disturbance. The inciting event was not witnessed; however, the injury distribution was compatible with high-energy blunt trauma (e.g., vehicular collision) and/or entanglement- associated limb injury.

On presentation, the animal had pale mucous membranes, delayed capillary refill time (>3 s), weak peripheral pulses, and tachypnoea (~60 breaths/min) with increased respiratory effort. Heart rate was 115 beats/min, and rectal temperature was 39.2°C (102.5°F). History indicated refusal of food and water for approximately 72–96 hours prior to capture; dehydration was estimated at $\geq 8\%$ based on skin turgor and mucosal dryness. Overall findings were most consistent with hypovolaemic shock with concurrent systemic inflammatory response in the context of a contaminated open wound.



Figure 1: Clinical image of the right hind limb of an adult striped hyena (*Hyaena hyaena*) at the time of admission.



Figure 2: Close-up procedural view of the hyena's distal hind limb during wound management under sedation. Devitalised muscle



Neurological examination of the pelvic limbs revealed flaccid paraplegia with absent proprioception and no detectable superficial or deep nociception. Anal tone was absent and the tail was atonic. Forelimb function was preserved, supporting a lesion caudal to the thoracic intumescence and most consistent with severe thoracolumbar spinal cord injury. Diagnostic imaging was not available; therefore, definitive differentiation among vertebral fracture/luxation, intervertebral disc extrusion, compressive haemorrhage, and cord transection was not possible.

The primary orthopaedic lesion involved the distal right pelvic limb, centred on the distal tibia proximal to the tarsocrural joint, and was consistent with a severe open fracture of the distal tibia (Gustilo–Anderson type III; provisional classification), with exposed cortical bone and extensive soft-tissue disruption. The wound was approximately 18 cm in length, extended into the craniolateral compartment, and was associated with myofascial necrosis and fibrinopurulent exudation. Subcutaneous emphysema was palpable, and cellulitis extended proximally towards the stifle. Distal perfusion could not be reliably quantified under field conditions; however, tissue viability appeared poor at presentation. Haematology and serum biochemistry were not available at presentation. Nevertheless, the combination of anorexia, depressed mentation, peripheral hypoperfusion, contaminated necrotic soft tissue, and malodorous exudate was strongly suggestive of established wound infection with systemic inflammatory response and high risk of bacteraemia and septic progression. Ipsilateral popliteal lymph node enlargement was consistent with reactive regional lymphadenopathy. The injury was estimated to be 72–96 hours old, with no documented prior lavage, debridement, or antimicrobial administration.

Using available clinical criteria, the patient was considered to have a poor prognosis based on the severity of the contaminated open fracture with extensive soft-tissue loss, non-ambulatory thoracolumbar neurotrauma with absent deep nociception, and suspected systemic infection. Accordingly, the case was managed as polytrauma with high risk of multiple organ dysfunction.

This presentation is consistent with severe delayed-presentation polytrauma in a peri-urban interface setting, where discovery, capture, and transport can substantially prolong time to definitive care. Emergency medical and wound interventions were initiated on admission and are summarised below.



Treatment and management

A structured four-day multimodal therapeutic protocol was implemented to address polytrauma, suspected spinal cord injury, and systemic inflammatory physiology with concern for septic progression. Interventions prioritised haemodynamic stabilisation, wound source control, empirical antimicrobial therapy, and supportive care within field-adapted operational constraints.

Systemic stabilisation and fluid resuscitation

Initial assessment indicated hypovolaemia with poor peripheral perfusion. Isotonic crystalloid (0.9% sodium chloride) was administered intravenously via a 20G cephalic catheter at 20 mL/kg over one hour (based on estimated body mass), followed by ongoing fluid support titrated to serial perfusion parameters (capillary refill time, mucous membrane colour, pulse quality) and hydration status.

Sedation and procedural control

Diazepam (0.5 mg/kg IM, administered as required) was used as an adjunct to facilitate handling for repeated wound care while aiming to minimise cardiopulmonary depression. The authors recognise that diazepam alone may provide variable immobilisation in free-ranging carnivores; however, under the prevailing constraints (no inhalational anaesthesia, limited monitoring, and restricted drug availability), it was used for its anxiolytic and muscle-relaxant effects to support procedural control.

Wound management and surgical intervention

The orthopaedic lesion was managed as a severe, contaminated open fracture (Gustilo– Anderson type III; provisional classification) with exposed tibial cortex and extensive myofascial disruption. On Day 1, sharp debridement under sedation was performed to remove gross contamination and clearly devitalised tissue, followed by high-volume lavage with warmed isotonic saline delivered under moderate pressure (approximately 8–12 psi, syringe- and-catheter technique). A dilute povidone-iodine solution was applied to the wound surface after lavage as an adjunct antiseptic measure.

Staged debridement on Days 2 and 3 addressed evolving demarcation of devitalised tissue. Paraffin-impregnated non-adherent dressings with sterile gauze overlays were applied and changed twice daily. Limited deep fascial apposition was performed using horizontal mattress sutures (non-absorbable monofilament nylon, 2-0) to reduce dead space and improve tissue alignment without sealing the contaminated wound bed. Primary skin closure was avoided to permit drainage and facilitate ongoing wound assessment.



Antimicrobial regimen

Systemic antibacterial therapy consisted of **ceftriaxone (25 mg/kg IM, once daily)**, selected for logistical feasibility and broad activity against many Gram-positive and Gram-negative organisms implicated in contaminated soft-tissue wounds. In the absence of culture and antimicrobial susceptibility testing, treatment was empirical and response was monitored using clinical trajectory, wound appearance, and perfusion parameters. Additional anaerobic coverage and/or combination therapy were not instituted owing to limited drug availability and inability to monitor renal and hepatic function under the prevailing constraints.

Nutrition and supportive management

Nutritional intake remained *nil per os* throughout the treatment period. Attempts to offer cooked minced meat and oral electrolyte solution were unsuccessful due to profound depression and recumbency. Enteral intubation was avoided owing to a high aspiration risk in a compromised wild carnivore, and parenteral nutritional support was not available. Non-steroidal anti-inflammatory drugs were withheld to reduce the risk of renal injury under suspected hypoperfusion and septic physiology. Analgesic options were limited by drug availability and monitoring constraints; nevertheless, sedation-assisted wound care and gentle handling were prioritised to minimise distress, and the grave prognosis was reassessed daily.

Clinical deterioration and outcome

By Day 3, systemic status deteriorated with persistent tachypnoea, declining peripheral perfusion, intermittent hypothermia (nadir ~37.9°C; 100.2°F), and progressive obtundation. By Day 4, marked bradycardia (heart rate <90 beats/min), mucosal cyanosis, and worsening mentation were consistent with decompensated shock and presumed progression to multiple organ dysfunction. The animal died spontaneously early on Day 5 post-admission. Post-mortem examination was not feasible under the prevailing constraints.

Discussion

This case documents advanced polytrauma in a free-ranging striped hyena (*Hyaena hyaena*) and illustrates how delayed presentation can markedly restrict feasible therapeutic options in wildlife emergencies. Severe open fracture with extensive soft-tissue contamination, profound thoracolumbar neurological deficits, and progressive shock physiology together supported a poor prognosis, with clinical deterioration consistent with septic progression despite supportive care.

As a synanthropic scavenger, *H. hyaena* increasingly utilises anthropogenically modified landscapes, including peri-urban corridors, agricultural peripheries, and forest



margins, where access to anthropogenic food resources is common. This behavioural plasticity increases exposure to trauma vectors such as road collisions, electrocution, and injuries associated with fencing, traps, and livestock-conflict interfaces (Vanak & Gompper, 2010; Mukherjee et al., 2010). These mechanisms frequently produce multisystem compromise and may be under-treated where rescue logistics and specialist infrastructure are limited.

The neurological findings (flaccid paraplegia, absent nociception, and loss of anal tone with preserved forelimb function) were most consistent with severe thoracolumbar spinal cord injury. In domestic carnivores, absence of deep pain perception is a strong negative prognostic indicator and may reflect profound cord contusion, ischaemic injury, or transection (Olby et al., 2001; Sharp & Wheeler, 2005). In this case, the lack of advanced imaging constrained definitive localisation and aetiology, reinforcing the importance of structured neurological assessment within decentralised wildlife triage protocols.

The distal tibial open fracture, extensive soft-tissue necrosis, and proximal cellulitis suggested a limb-salvage scenario with low likelihood of success in the absence of immediate debridement, definitive stabilisation (osteosynthesis), and soft-tissue coverage. Amputation or advanced reconstructive approaches were not feasible given delayed presentation, suspected systemic compromise, and limited anaesthesia and surgical infrastructure. Ongoing contamination and devitalised tissue likely contributed to escalation of systemic inflammation and shock physiology, culminating in clinical deterioration compatible with multiple organ dysfunction.

Empirical antimicrobial monotherapy with ceftriaxone was chosen for logistical feasibility; however, without culture and susceptibility testing, adequacy of spectrum and dosing could not be confirmed. In heavily contaminated necrotic wounds, anaerobic organisms may contribute to infection burden; where feasible and clinically appropriate, addition of anaerobic coverage (e.g., metronidazole or clindamycin) may be considered, ideally alongside patient monitoring and local antimicrobial stewardship guidance. Non-steroidal anti-inflammatory drugs were withheld to reduce the risk of renal injury under suspected hypoperfusion and septic physiology.

The case also reflects a broader systems gap: the absence of a mature pre-hospital wildlife trauma pathway that reliably reduces time from injury to definitive care. In human and companion-animal trauma, early stabilisation within the “golden hour” is associated with improved outcomes; in many wildlife settings, discovery, capture logistics, transport, and jurisdictional constraints can extend this interval to days. Here, the estimated >72-hour delay



likely reduced the probability of meaningful neurotrauma intervention and increased the risk of established infection and systemic complications by the time of presentation.

Although the species is listed as Near Threatened by the IUCN, this status does not consistently translate into access to species-specific clinical protocols or resourcing for rescue and rehabilitation. Under-reporting of injury events, limited diagnostic follow-up, and inconsistent post-mortem investigation constrain interpretation of population-level impacts and reduce opportunities to refine evidence-based clinical pathways for *H. hyaena*.

Post-mortem examination and ancillary diagnostics (e.g., histopathology, bacteriology) were not performed because of limitations in biosafety infrastructure, personal protective equipment availability, and cold-chain capacity. This constrained pathological correlation of the neurological and systemic findings and limited confirmation of infectious aetiology.

Conclusion

This case illustrates a time-critical wildlife polytrauma scenario in which delayed presentation, a severe contaminated open distal tibial fracture, and suspected thoracolumbar spinal cord injury were followed by systemic deterioration consistent with septic progression and multiple organ dysfunction. Even with structured supportive care and wound management, the clinical window for meaningful limb salvage and neurotrauma recovery was likely exceeded before admission. Strengthening decentralised rescue logistics, standardised triage (including neurological and wound-severity scoring), and access to essential diagnostics and therapeutics may improve outcomes for ecologically important mesocarnivores such as *Hyaena hyaena*.

Learning points / take-home messages

- Wildlife trauma cases reflect not only individual injuries but underlying ecological and systemic vulnerabilities at the human–wildlife interface.
- Delayed intervention in wildlife emergencies represents a missed opportunity for both individual recovery and clinical knowledge generation.
- Non-flagship species, such as the striped hyena, highlight structural gaps in rescue priorities and reveal biases within conservation and health frameworks.
- The absence of coordinated wildlife trauma response systems underscores the need to integrate veterinary care with ecological risk assessment and public health preparedness.
- Systematic documentation of wildlife injuries can inform species-specific clinical protocols and support evidence-based conservation strategies.



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