Acta Scientiae Veterinariae, 2025. 53(Suppl 1): 1033.

CASE REPORT
Pub. 1033

ISSN 1679-9216

Head Trauma in the Eurasian Lynx (*Lynx lynx dinniki*)

Mustafa Arican[1], Hilmican Ergin[1], Yasemin Tanirli[1], Süleyman Serhat İyigün[2] & Elgin Orçum Uzunlu[1]

ABSTRACT

***Background*:** The Eurasian *Lynx lynx dinniki* is in danger of extinction in Iran and Turkey. Many wild animals are injured in traffic accidents every year. Head trauma is a common cause of morbidity and mortality in small animals. To ensure the best outcome in such patients, a rapid diagnosis should be made and early treatment should be started. In this case report, we describe the current emergency trauma procedure for a lynx with head trauma. In addition, the biochemical and clinical examination parameters noted during the examination are given for the 1st time as a contribution to the literature. ***Case*:** A 2-4-month-old female *Lynx lynx dinniki*, weighing 1.7 kg, was brought to Emergency Clinic of the Veterinary Faculty, Selcuk University, by the Forestry officials of the Ministry of Agriculture, with complaint of traffic accident. On examination, the lynx was found to be making unconscious flapping movements with its forelimbs and was unresponsive to the environment. Detailed examination with a fundus camera of both eyes revealed foci of arterial and venous haemorrhages in the fundus layer. Radiographic examination showed no abnormal findings in the thorax. However, oedema in the skull and effusion in the abdomen were observed. The effusion was transudate. During the treatment phase, daily transamine [10 mg/kg, IM], vitamin K [1 mL/kg, SC], prednisolone [0.5 mg/kg], mannitol [1 mg/kg], isotonic solution [1 mL/min to 100 mL, IV] in an animal intensive care unit with 56% humidity, 240C temperature and continuous oxygen, isotonic solution [1 mL/min to 100 mL IV], dextrose [1 mL/min to 3 mL IV], duphalayte [1 mL/min to 5 mL IV], vitamin C [50 mg/kg, SC], vitamin B12 [40 mcg/kg] and ceftriaxone [40 mg/kg, IV] for prophylaxis. Normal ambulation on day 11 of treatment. ***Discussion*:** The causes of death in lynxes have been identified in 5 main categories: disease, fighting, road accidents, poaching and unknown causes. Disease-related mortality was determined on the basis of molecular analyses, macroscopic findings, microbiology and histopathology. Traffic accidents and trauma are among the leading causes. Therefore, 1st aid is needed depending on the severity of trauma and lesions. In this case report, Trauma triage and modified Glasgow coma scale scores, which were used for the 1st time in a Lynx lynx dinniki, were thought to provide a lower mortality rate by allowing objective measurement of trauma-specific disease severity and injury severity. For the case presented here, although some values are available in the literature for lynxes, some values were tried to be discussed by adapting them to cats. WBC value was found to be high in the lynx. In the case presented, granulocytosis and monocytosis were considered to develop due to traumatic injury. In the present case, the cause of thrombocytopenia is thought to be the development of consumptive coagulopathy due to head trauma. In this case, upper limit Na and high Cl values were found in blood gases. High blood Na and Cl values are thought to be dehydration developing after trauma. Blood CPK and glucose values were found to be high. Low serum albumin and total protein amount are thought to cause abdominal effusion with transudate character. Hypoalbuminemia, hypoproteinaemia, low BUN and creatine levels are thought to be related to malnutrition developing after trauma. In this case, the reason for hyperbilirubinemia in the patient is thought to be increased bilirubin production due to tissue damage caused by trauma.

Keywords: animal trauma triage score, modified Glasgow coma scale, lynx.

DOI: 10.22456/1679-9216.143900

Received: 12 November 2024 Accepted: 8 May 2025 Published: 7 June 2025

[1]Department of Surgery & [2]Department of Internal Medicine, Faculty of Veterinary Science, Selçuk University, Konya, Turkey. CORRESPONDENCE: M. Arican [marican@selcuk.edu.tr]. Department of Surgery, Faculty of Veterinary Medicine, Selcuk University. 42130 Selcuklu, Konya, Turkey.

INTRODUCTION

The Eurasian lynx (*Lynx lynx dinniki*) is species with a wide distribution range spanning northern parts of Europe and Asia [12,25,26]. The Caucasian *Lynx lynx dinniki* [1,11] is a subspecies of the common lynx endemic to the Caucasus, Iran, Turkey and European Russia [5,28].

Many wild animals are injured in traffic accidents every year [4,22]. Heaver and Waters [13] determined the mortality rate due to trauma as 5% among the causes of death of lynx species in the zoo. Volker *et al*. [27] reported the traumatic mortality rate as 26% (4/15) in lynxes living in natural environments under supervision [15,28]. In a study conducted in Switzerland, 34% of the non-infectious causes of mortality in lynx were reported as traffic accidents [21]. Head trauma is a common cause of morbidity and mortality in small animals. Head trauma can lead to traumatic brain injury (TBI), defined as structural or physiological disruption of the brain by an external force [23]. To ensure the best outcome in such patients, a rapid diagnosis should be made and early treatment should be started [15,24]. Although the initial clinical presentation of a patient with head trauma may seem poor, even patients with severe neurological disorders have reported that they can recover with appropriate care. Death is typically caused by progressive increases in intracranial pressure [23].

In this case report, we describe the current emergency trauma procedure for a Eurasian lynx (*Lynx lynx dinniki*) with head trauma. In addition, the biochemical and clinical examination parameters noted during the examination are given for the 1st time as a contribution to the literature.

CASE

A 2-4 months old, female, 1.7kg, Eurasian lynx (*Lynx lynx dinniki*), was brought to Selcuk University, Veterinary Faculty, Emergency Clinic by the Ministry of Agriculture and Forestry officials with complaint of traffic accident (Figure1 A & B).

On examination, it was observed that the lynx made unconscious flapping movements with its front extremities and had no sensitivity to the environment. Vision problem was noted. Clinical examination revealed that the temperature was 37.70 C (normal; 37.8 - 39.90 C, [18] heart rate was 42 per minute (normal; 40 - 50 per minute, [19] respiratory rate was 10 per minute (normal; 10 per minute [18]. No abnormal respiratory sound was found on auscultation. Pupillary reflex was absent bilaterally and the retina was normal on ultrasound examination of both eyes with a 7.5 MHz probe (Figure 2 A & B). The menace test showed no visual function. When the patient presented to the clinic, the severity of trauma was determined using the Modified Glasgow Scale (MGS) and Trauma Triage Scoring (TTS) systems. Accordingly, the MGS result was 4 (significant) and the TTS result was 3. The study was carried out with the permission of Animal Experiments Local Ethics Committee Selcuk University, Faculty of Veterinary Medicine.

Tonometry showed that the intraocular pressure was 25 mmHg in the right eye and 19 mmHg in the left eye. Funduscopic examination of the retina revealed foci of haemorrhage in the retina (Figure 3 A & B). No abnormal findings were found on examination of the extremities and muscles. Radiological examination included V/D and L/L radiographs of the cranium (Figure 4 A & B) and L/L and V/D radiographs of the thorax and abdomen (Figure 5 A & B).

Radiographic examination revealed no abnormal findings in the thorax. However, oedema in the cranium and effusion in the abdomen were observed. The effusion was transudate (Sg: 1008, protein: 0.7 g/dL). Ultrasound examination of the abdomen revealed that the left kidney was 8.00 mm in width and the calyx was enlarged (Figure 6 A and B).

In laboratory examination: The venous blood gas results indicated mild hypernatremia (161 mmol/L; Ref.: 119–158 mmol/L) and hyperchloremia (131 mmol/L; Ref.: 81–121 mmol/L). The complete blood count showed leukocytosis (WBC 18.4 m/mm³; Ref.: 1.5–11.4 m/mm³), monocytosis (Mon 0.77 m/mm³; Ref.: 0.1–0.7 m/mm³), and granulocytosis (Gra 15.5 m/mm³; Ref.: 0.6–8.13 m/mm³). Serum biochemistry results revealed low levels of BUN (20.4 mg/dL; Ref.: 21.5–69.1 mg/dL) and creatinine (0.4 mg/dL; Ref.: 1.3–2.98 mg/dL), as well as hypoalbuminemia (3.2 g/dL; Ref.: 4.3–5.1 g/dL). Additionally, hyperglycemia (Glucose: 256 mg/dL; Ref.: 37.8–248 mg/dL), hyperbilirubinemia (0.6 mg/dL; Ref.: 0–0.1 mg/dL), and elevated CPK levels (1754 U/L; Ref.: 254–655 U/L) were noted. Reference values were taken from previous studies on lynxes [2,19], values not found in these studies and measured for the 1st time in lynxes were taken into consideration as cat reference values [5,19].

During the treatment phase, daily transamine[1] [Tranexel - 10mg/kg, IM], vitamin K2 [Hemadur K - 1 mL/kg, SC], prednisolone[2] [Cortal - 0.5 mg/kg, IM], mannitol[3] [Poliflesk 20% - 1 mg/kg, IV], isotonic solution[3] [Polifleks 0.9% Isotonic Sodium Chloride - 1 mL/min to 100 mL, IV] in a pet intensive care unit with 56% humidity, 24^{0}C temperature and continuous oxygen (Figure 7A). Isotonic solution[3] [Polifleks 0.9% Isotonic Sodium Chloride - 1 mL/min to 100 mL, IV], dextrose[3] [Polifleks 5% Dextrose - 1 mL/min to 3 mL, IV], Duphalayte[4] [1 mL/min, 5 mL IV), vitamin C[5] [Vit Ce - 50 mg/kg, SC], vitamin B12[6] [Dodeks - 40 mcg/kg, SC) and ceftriaxone[7] [Eqiceft 500 mg - 40 mg/kg, IV] for prophylactic purposes. Normal walking on day 11 of treatment (Figure 7B).

Figure 1. A- A 2-4-month-old female Eurasian lynx (*Lynx lynx dinniki*), weighing 1.7 kg, was brought to Emergency Clinic with complaint of traffic accident. B- Oxygen therapy was administered as soon as possible.

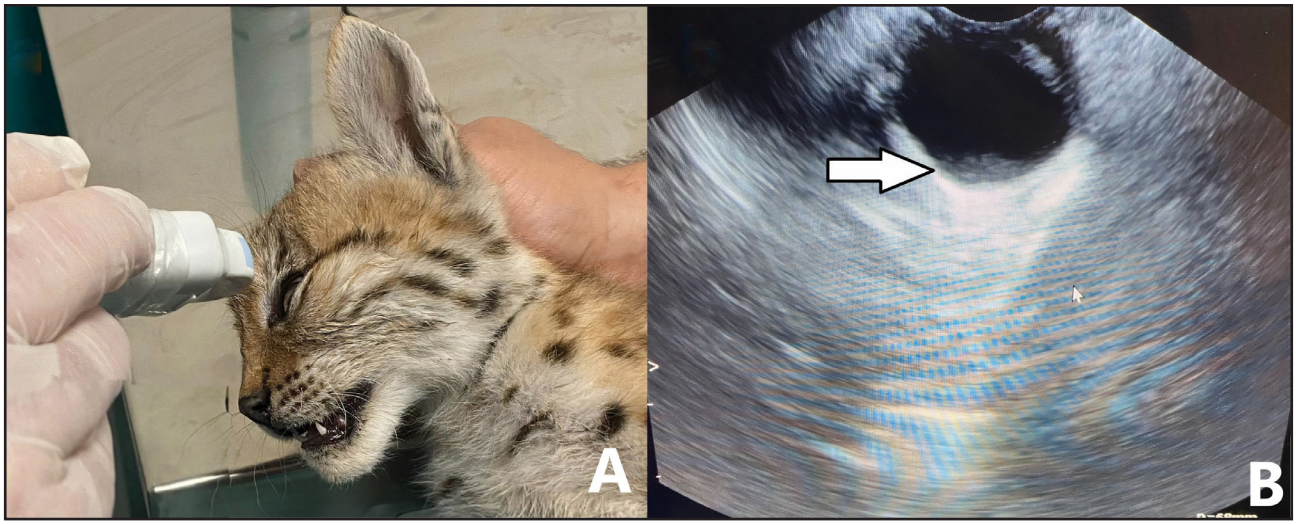

Figure 2. Pupillary reflex was absent bilaterally and A- The retina was normal on ultrasound examination of both eyes with a 7.5 MHz probe. B- No detachment of the retina was observed (white arrow).

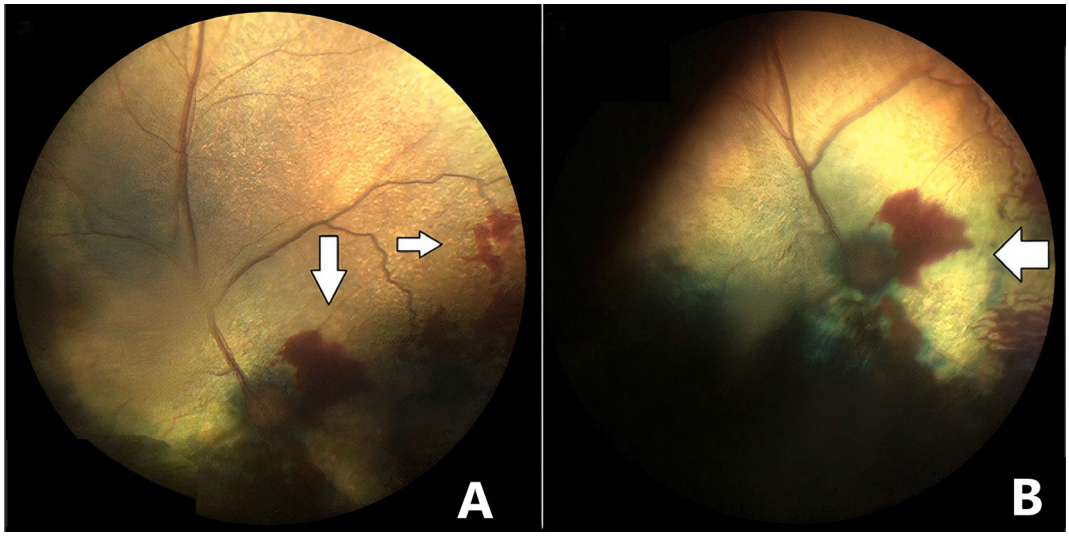

Figure 3. Funduscopic examination of the retina revealed foci of haemorrhage in the retina. A- Foci of haemorrhage were seen around the optic nerve (white arrows). B- Diffuse haemorrhage foci were seen dorsal to the optic nerve.

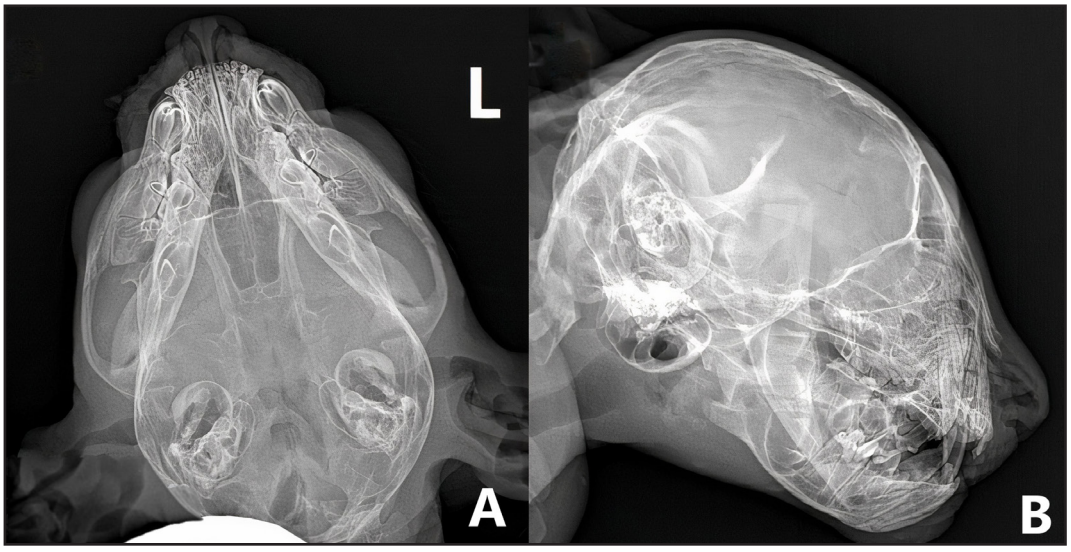

Figure 4. Radiological examination included V/D (A) and L/L (B) radiographs of the cranium.

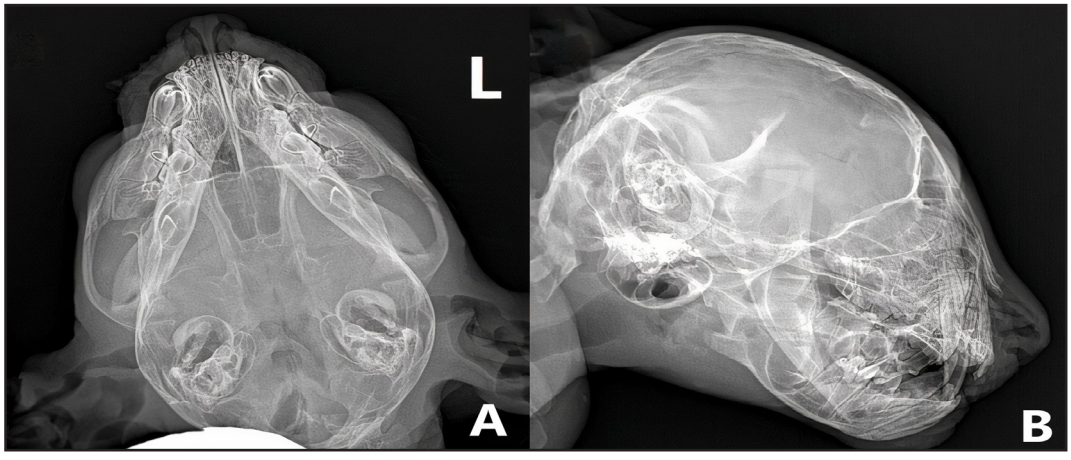

Figure 5. Radiographs of the thorax and abdomen: L/L (A) and V/D (B) thorax and abdomen radiographs were observed.

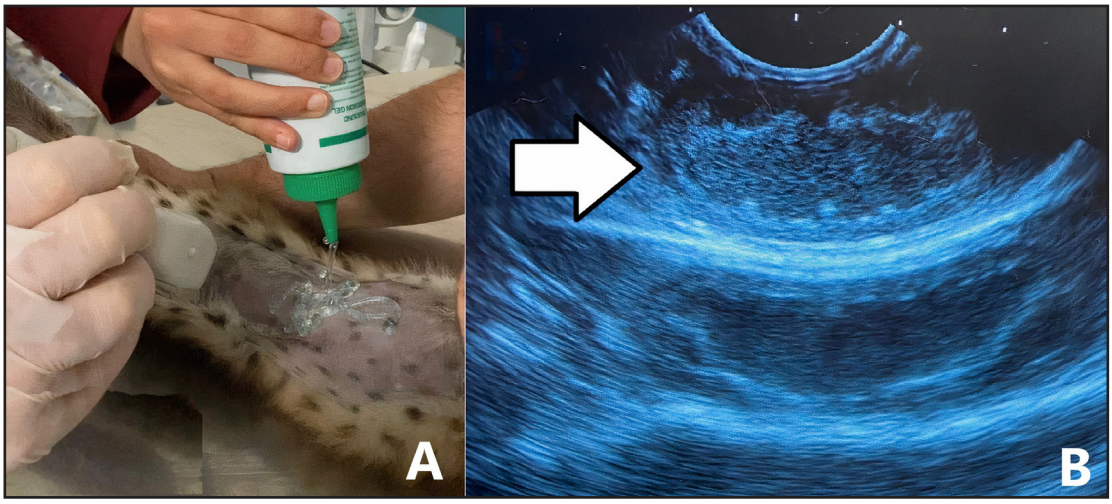

Figure 6. Ultrasound examination of the abdomen (A) revealed that the left kidney was 8.00 mm in width and the calyx was enlarged (B).

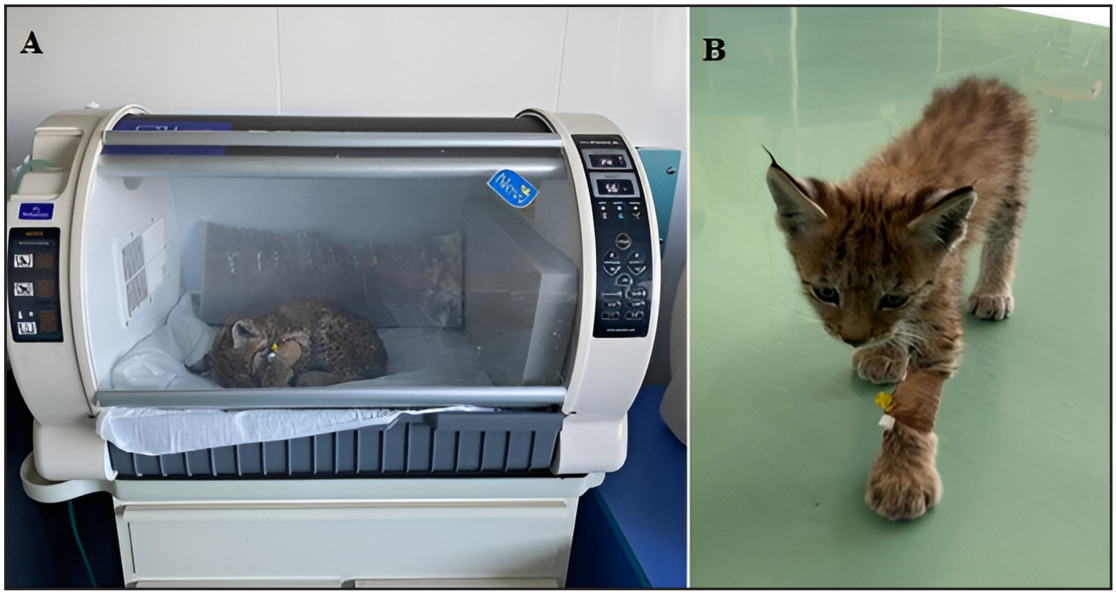

Figure 7. Treatment phase. A- Pet intensive care unit. B- Normal walking on day 11 of treatment.

DISCUSSION

The causes of death in lynxes have been identified in five main categories: disease, fighting, road accidents, poaching and unknown causes. Disease-related mortality was determined on the basis of molecular analyses [12], macroscopic findings, microbiology and histopathology [16]. Traffic accidents and trauma are among the leading causes. Therefore, first aid is needed depending on the severity of trauma and lesions.

In this report, Trauma triage and modified Glasgow coma scale scores, which were used for the 1st time in a Lynx (*Lynx lynx dinniki*), were thought to provide a lower mortality rate by allowing objective measurement of trauma-specific disease severity and injury severity [20]. The animal trauma triage score has established ideal predictive performance for survival in the traumatised cat population [3]. The trauma triage scoring system prevents the evaluation of perfusion, respiratory, cardiac, eye/muscle/skin, skeletal and neurological subcategories from being overlooked during serial examination in injured cats. Thus, it provides clinicians with the convenience of not skipping any subject while making a diagnosis [20]. In this case report, according to the Animal Trauma Triage Scoring

System, only perfusion and neurological parameters are altered. The others were at the same level.

Modified Glasgow coma score and trauma triage scores of 711 cats were evaluated in various studies [7,14]. According to Glasgow coma scoring, the condition is evaluated as critical (3-8 points), moderate (9-14 points) and good (15-18 points). The trauma triage score of 26% of these cats was determined as 1 point, 17% as 2 points and 13% as 3 points. Only 9 cats were observed to have a triage score of '>10'. In 66 cats (9.3%) without head trauma, the abnormal modified Glasgow coma score was recorded as '<18'. It was observed that 71% of the cats had a modified Glasgow coma score of '18', which corresponds to a normal examination [7,14]. Thus, according to the modified Glasgow coma scale scoring, 27 of 30 cats (90%) were scored as good, 2 as moderate (6.6%) and 1 as poor (3.3%). According to the modified Glasgow coma score, 3.3% of the cats were bad (3-8), 6.6% were moderate (9-14) and 90% were good (15-18). When evaluated according to the criteria of the patient scale, the patient is given scores between 3 (indicating deep loss of consciousness), 9-14 (indicating moderate damage), 15-18 (measured by the capacity to use motor movement functions). Vertebral lesions were found in 2 of the moderate and critical cases and bilateral fractures of the right and left femur were found in the other case. The 3 patients who were scored as moderate and poor died [3]. This situation revealed the necessity of more careful surveillance of patients with poor scoring in diagnosis. When motor functions, brainstem reflexes and consciousness levels were evaluated in the presented case, animal supine, hypotonia, depressed muscles or no spinal reflexes were observed. Bilateral unresponsive mydriasis and decreased or absent oculocephalic reflexes. The semi-comatose state responds only to repeated noxious stimuli. All this was attributed to the trauma and its duration. According to the modified Glasgow coma score, the case was evaluated as serious. Treatment was started immediately. The patient improved as a result of the treatment. When the fundus was examined in the clinical examination of the eye, haemorrhage foci on the retina were recorded. This was thought to be formed after trauma. During the treatment, she was very interested in the surroundings.

For the case presented here, although some values are available in the literature for lynxes, some values were tried to be discussed by adapting them to cats. WBC value was found to be high in the lynx. Neutrophils and monocytes form the 1st line of immune defence following an infection or injury. Both are released into circulation from the bone marrow and recruited to sites of infection or tissue damage in response to pathogen-derived signalling molecules or host-produced inflammatory signalling molecules, respectively. While leucocyte counts of severely injured patients remain within the normal range, the proportion of granulocytes is significantly increased compared to healthy individuals. Emergent granulopoiesis, which has been extensively described following traumatic injury and microbial challenge, is part of the 1st line of cellular defence that significantly modulates repair processes after tissue damage [10,17]. In the case presented, granulocytosis and monocytosis were considered to develop due to traumatic injury. Consumption coagulopathy often develops in head trauma patients in the absence of another major trauma or bleeding. Coagulopathy is defined as prolonged prothrombin time (PT) and partial thromboplastin time (PTT) and decreased platelet count [18]. In the present case, the cause of thrombocytopenia is thought to be the development of consumptive coagulopathy due to head trauma.

In the presented case, upper limit Na and high Cl values were found in blood gases. High blood Na and Cl values are thought to be dehydration developing after trauma [9]. Most likely, after being traumatised, it was difficult to get water to drink. Blood CPK and glucose values were found to be high. Stress response in trauma patients triggers increased plasma catecholamine and glucocorticoid levels, which leads to hyperglycaemia [2]. CPK has a high muscle specificity and increases in cats due to muscle damage. The presence of muscle tissue damage is supported by increased CPK and partly by increased activity of less muscle tissue-specific enzymes such as LDH and AST [8]. Low serum albumin may cause peripheral oedema, ascites and pleural effusion [6]. Low serum albumin and total protein amount are thought to cause abdominal effusion with transudate character. Hypoproteinaemia and decreases in BUN concentrations can be seen as a result of low protein intake [17]. Hypoalbuminemia, hypoproteinaemia, low BUN and creatine levels are thought to be related to malnutrition developing after trauma. Hyperbilirubinemia in patients with severe trauma can be caused by many factors as a result of excessive bilirubin production which may be triggered by haematoma, blood leakage from damaged tissues

or haemolysis [6]. In the present case, the reason for hyperbilirubinemia in the patient is thought to be increased bilirubin production due to tissue damage caused by trauma.

It is recommended that the Trauma Triage Scoring system and Glasgow Coma Scoring system should be performed systematically in emergency clinics or emergency cases in order to know the lesions that may occur due to trauma in advance and to make a rapid preparation for them. General life functions of all traumatised patients should be performed without haste but serially. Especially thoracic radiographs of traumatised patients should be examined. However, we did not encounter any pathology on radiological examination of the cranium, thorax, and abdomen in the case presented here. In addition to clinical examination, ultrasonographic examinations provide important information for abdominal organ damage. Ultrasonographic examinations, especially of the liver, spleen and urinary bladder, are very important in terms of confirming the diagnosis. In patients presenting with trauma, lesions that may occur in the liver, spleen and urinary bladder can be understood by ultrasonographic examinations. Ultrasound examination did not reveal any pathological changes in the abdomen for this case. Ultrasonographic examination of the eye revealed fibrin deposition in the retina.

It has been determined that the initial use of modified Glasgow coma scale and animal trauma triage scoring in cases brought to the clinic for trauma or other reasons provides clinicians with the opportunity to rapidly classify the cases according to their urgency, to create a treatment protocol and to make a useful and objective evaluation in terms of the prognosis of the case. In addition, treatment procedures were established with detailed laboratory examinations.

MANUFACTURERS

[1]Haver Farma İlaç A.Ş. İstanbul, Turkey.
[2]Alke Sağlık Ürünleri San. Ve Tic. A.Ş. İstanbul, Turkey.
[3]Polifarma İlaç San. ve Tic. A.Ş. Tekirdağ, Turkey.
[4]Zoetis Orion Pharma. Espoo, Finland.
[5]Sanovel İlaç Sanayi ve Ticaret Anonim Şirketi. İstanbul, Turkey.
[6]Vetaş, Deva Holding A.Ş. Tekirdağ, Turkey.
[7]Tüm Ekip İlaç A.Ş. İstanbul, Turkey.

Ethical approval. The study was carried out with the permission of Selcuk University, Faculty of Veterinary Medicine, Animal Experiments Local Ethics Committee dated 2.11.2023 and numbered 630625.

Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

REFERENCES

1 Albayrak İ. 2012. New record of *Lynx lynx* (L., 1758) in Turkey (Mammalia: Carnivora). *Turk Journal Zoology*. 36: 814-819. DOI: 10.3906/zoo-1110-16

2 Aroch I., Keidar I., Himelstein A., Schechter M., Shamir M.H. & Segev G. 2010. Diagnostic and prognostic value of serum creatine-kinase activity in ill cats: a retrospective study of 601 cases. *Journal of Feline Medicine and Surgery*. 12(6): 466-475. DOI: 10.1016/j.jfms.2010.01.0

3 Ash K., Hayes G.M., Goggs R. & Sumner J.P. 2018. Performance evaluation and validation of the animal trauma triage score and modified Glasgow Coma Scale with suggested category adjustment in dogs: a VetCOT registry study. *Journal of Veterinary Emergency and Critical Care*. 28(3): 192-200. DOI: 10.1111/vec.12717

4 Atkinson M.W. 1997. New perspectives on wildlife rehabilitation. *Zoo Biology*. 16(4): 355-357. DOI: 10.1002/(SICI)1098-2361(1997)16:4<355::AID ZOO8>3.0.CO;2-9

5 Badenkov Y.P. & Vashakmadze V. 2000. Introduction. In: Price M.F. (Ed). *Cooperation in the European Mountains 2: The Caucasus*. Cambridge: Black Bear Press Ltd., pp.1-4.

6 Barsanti J.A 2012. Urinary Disorders In: Willard M.D. & Tvedten H. (Eds). *Small Animal Clinical Diagnosis by Laboratory Methods*. 5th edn. St. Louis: Elsevier, pp.148- 279. DOI: 10.1016/B978-1-4377-0657-4.00007-7

7 Cameron S., Weltman J.G. & Fletcher D.J. 2021. The prognostic value of admission point-of-care testing and modified Glasgow Coma Scale score in dogs and cats with traumatic brain injuries (2007-2010): 212 cases. *Journal of Veterinary Emergency and Critical Care*. 32(1): 75-82. DOI: 10.1111/vec.13108

8 Conner B.J. 2017. Treating Hypoalbuminemia. *Veterinary Clinics: Small Animal Practice*. 47(2): 451-459. DOI: 10.1016/j.cvsm.2016.09.009

9 Eakins J. 2009. Blood glucose control in the trauma patient. *Journal of Diabetes Science and Technology*. 3(6): 1373-1376. DOI: 10.1177/193229680900300617

10 Engström M., Romner B., Schalén W. & Reinstrup P. 2005. Thrombocytopenia Predicts Progressive Hemorrhage after Head Trauma. *Journal of Neurotrauma*. 22(2): 291-296. DOI: 10.1089/neu.2005.22.291

11 Gimenez O., Gatti S., Duchamp C., Germain E., Laurent A., Zimmermann F. & Marboutin E. 2019. Spatial density estimates of Eurasian lynx (*Lynx lynx*) in the French Jura and Vosges Mountains. *Ecology and Evolution*. 9(20): 11707-11715. DOI: 10.1002/ece3.5668

12 Goettling J., Goeritz F., Jewgenow K. & Painer J. 2016. Serum chemistry and haematology for female Eurasian lynx (*Lynx lynx*). *European Journal of Wildlife Research*. 62(3): 365-367. DOI: 10.1007/s10344-016-0990-4

13 Heaver J. & Waters M.A. 2019. Retrospective study of mortality in Eurasian lynx (*Lynx lynx*) in UK zoos. *Zoo Biology*. 38(2): 200-208. DOI: 10.1002/zoo.21476

14 Janicova A., Becker N., Xu B., Simic M., Noack L., Wagner N., Müller A.J., Bertrand J., Marzi I. & Relja B. 2021. Severe Traumatic Injury Induces Phenotypic and Functional Changes of Neutrophils and Monocytes. *Journal of Clinical Medicine*. 10(18): 4139. DOI: 10.3390/jcm10184139

15 Kuo K.W., Bacek L.M. & Taylor A.R. 2018. Head Trauma. *Veterinary Clinics: Small Animal Practice*. 48(1): 111-128. DOI: 10.1016/j.cvsm.2017.08.005

16 Lapsley J.H., Galina M.S. & Julia P. 2019. Performance evaluation and validation of the Animal Trauma Triage score and modified Glasgow Coma Scale in injured cats: A Veterinary Committee on Trauma registry study. *Journal of Veterinary Emergency and Critical Care*. 29(5): 478-483. DOI: 10.1111/vec.12885

17 Lee M., Jang M., Jo J., Yu B., Lee G., Lee J., Lee S., Jeon Y. & Choi K. 2023. Hyperbilirubinemia as a Risk Factor for Mortality and Morbidity in Trauma Patients. *Journal of Clinical Medicine*. 12(13): 4203. DOI: 10.3390/jcm12134203

18 Lewis J. 2018. Endocrine and Metabolic Disorders. In: Porter P.S. (Ed). *The Merck Manual of Diagnosis and Therapy*. 20th edn. Hoboken: Merck & Co. Inc., pp.882-1045.

19 Meli M.L., Cattori V., Martínez F., López G., Vargas A., Palomares F., López-Bao J.V., Hofmann-Lehmann R. & Lutz H. 2010. Feline leukemia virus infection: A threat for the survival of the critically endangered Iberian lynx (*Lynx pardinus*). *Veterinary Immunology and Immunopathology*. 134(1): 61-67. DOI: 10.1016/j.vetimm.2009.10.010

20 Pınar O. & Arıcan M. 2022. Evaluation of Triage and Glasgow Coma Scale Findings in Cats in Trauma Emergencies. *Kocatepe Veterinary Journal*. 15(3): 285-296. DOI: 10.30607/kvj.1063835

21 Schmidt-Posthaus H., Breitenmoser-Würsten C., Posthaus H., Bacciarini L. & Breitenmoser U. 2002. Causes of mortality in reintroduced Eurasian lynx in Switzerland. *Journal of Wildlife Diseases*. 38(1): 84-92. DOI: 10.7589/0090-3558-38.1.84

22 Seiler A., Helldin J.O. & Seiler C. 2004. Road mortality in Swedish mammals: Results of a drivers' questionnaire. *Wildlife Biology*. 10(3): 225-233. DOI: 10.2981/wlb.2004.028

23 Simpson S., Syring R. & Otto C. 2009. Severe blunt trauma in dogs: 235 cases (1997–2003). *Journal of Veterinary Emergency and Critical Care*. 19(6): 588-602. DOI: 10.1111/j.1476-4431.2009.00468.x

24 Sorjonen D.C., Thomas W.B., Myers L.J. & Cox N.R. 1991. Radical cerebral cortical resection in dogs. *Progress in Veterinary Neurology*. 2(4): 225-236.

25 Sunquist F. & Sunquist M. 2009. Family Felidae (cats). In: Wilson D, Mittermeier R. (Eds). *Handbook of the Mammals of the World.* Carnivores. Barcelona: Lynx Edicions, pp.54-168.

26 The International Union for Conservation of Nature's (IUCN) Red List of Threatened Species Red List of Threatened Species. 2014. IUCN SSC Cat Specialist Group (wild cats): *Lynx lynx*. Cambridge. ver 3.1.

27 Volker I., Boer M., Baumgartner W. & Wohlsein P. 2017. Diseases in captive and reintroduced Eurasian lynx (*Lynx lynx*) from northwestern Germany. BMTW. 130: 72-77.

28 von Arx M., Breitenmoser-Würsten C., Zimmermann F. & Breitenmoser U. 2004. Species Information. In: von Arx M, Breitenmoser-Würsten C., Zimmermann F. & Breitenmoser U. (Eds). *Status and conservation of the Eurasian lynx* (Lynx lynx) *in Europe in 2001*. Thunstrasse: KORA Bericht No. 19, pp. 6-8.