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RESEARCH ARTICLE

Treatment Results of Traumatic Injuries in 20 Roe Deer *(Capreolus capreolus)*: A Retrospective Study [1]

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Summary

The purpose of this study is to present the treatment results of traumatic injuries in 20 roe deer. Twenty roe deer in various sex and age were admitted with complaint of traumatic injuries. Prior to examination, the roe deer were sedated with xylazine HCl (1.1 mg/kg BW). Anesthesia was induced with intravenous administration of diazepam (0.2 mg/kg BW) and ketamine HCl (1.1 mg/kg BW) combination. Afterward, they were intubated and anesthesia was maintained with isoflurane (2-3%). Fractures of long bones (n=8) and vertebrae (n=1), hip (n=2) and hock joint (n=2) luxation, phalangeal dislocation and tendon rupture (n=1) were diagnosed. Corneal erosion, infected bite wound on perianal region and pyelonephritis, bite wound and hypovolemic shock, internal bleeding including hypovolaemic shock, abscess on thorax and hernia inguinalis, and open wounds on the right knee (n=6) were detected. Of the 20 roe deer, 7 were recovered, 4 were euthanized, 2 were died without treatment, and 7 were died despite the surgical intervention. As a result it was concluded that, sedation performed during transport, preoperative intervention, and postoperative rehabilitation period is found to be the foremost factor in avoiding stress and stress associated mortality.

Keywords: *Retrospective study, Roe deer, Trauma, Treatment*

Karacalarda *(Capreolus capreolus)* Travmatik Yaralanmalar ve Sağaltım Sonuçları: 20 Olguda Retrospektif Çalışma

Özet

Bu çalışmanın amacı, travmatik olarak yaralanan 20 karacanın sağaltım sonuçlarının sunulmasıdır. Farklı cinsiyet ve yaştaki yirmi karaca travmatik yaralanma şikayeti ile getirildi. Muayeneden önce karacalar xylazine HCl (1.1 mg/kg) ile sedasyona alındı. Diazepam (0.2 mg/kg) ve ketamine HCl (1.1 mg/kg) kombinasyonu intravenöz uygulanarak indüksiyonu sağlandı. Daha sonra entübe edilerek isofloran (2-3%) ile anestezinin idamesi sağlandı. Uzun kemiklerde (n=8) ve vertebrada (n=1) kırıklar, kalça (n=2) ve topuk (n=2) eklemlerinde çıkıklar, falankslarda dislokasyon ile tendo rupturu (n=1) tespit edildi. Korneal erozyon, perineal bölgede enfekte ısırık yarası ve pyelonefritis, ısırık yarası ve hipovolemik şok, iç kanama ve buna bağlı hipovolemik şok, toraks bölgesinde apse ve inguinal fıtık, sağ diz bölgesinde açık yara (n=6) olduğu belirlendi. Çalışma sonunda 20 karacanın 7'si iyileşti, 4'üne ötenazi uygulandı, 2'si herhangi bir sağaltım uygulanamadan öldü ve 7'si de operatif müdahaleye rağmen öldü. Sonuç olarak transport, preoperatif müdahale ve postoperatif rehabilitasyon işlemleri sırasındaki uygulanan sedasyonun, stres ve buna bağlı şekillenen mortalitenin önlenebilmesi için gerekli olan en önemli faktör olduğu kanısına varıldı.

Anahtar sözcükler: *Retrospektif çalışma, Karaca, Sağaltım, Travma*

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INTRODUCTION

The roe deer *(Capreolus capreolus)* is a valuable wild ungulate because of its ecologic function-it acts as an undergrowth cleaner-and its economic importance as a game animal [1]. There are few studies conducted on roe deer [2-3]. Using clinical, hematologic and biochemical parameters, Montane et al.[2] evaluated the acute stress response caused by physical capture in roe deer and the effect of acepromazine on this response. Nordberg et al.[3] investigated the composite fixation on bonded roe deer vertebrae. Spraker [4], Williams and Thorne [5] reported that physical restraint in excitable wild ungulates can result in exertional myopathy, also called exertional rhabdomyolysis or capture myopathy. Montane et al.[6] reported that they observed delayed acute capture myopathy in three roe deer captured by drive-nets and transported thereafter to an enclosure for scientific purposes.

Hewison [7] investigated the relationship between morphological variation of the skull and female fecundity in roe deer from 13 populations across the deer's entire range found in Britain. Salcı et al.[8] reported that they observed multiple mandible and maxillary fracture in a Red Deer in Turkey. Kabak and Onuk [9] reported that macro anatomical investigations of the cranial cervical ganglion in roe deer. Duzler et al.[10] reported that macro anatomical investigation on trachea and the cartilages of larynx in the gazelle *(Gazella subgutturosa)*. Sindak and Biricik [11] investigated tiletamin-zolazepam-xylazine anaesthesia in the gazelle (*Gazella subgutturosa).* Topal and Gul [12] evaluated the effect of anaesthesia on hematological and serum biochemical values of red deer *(Cervus elaphus)*.

Clinicians can be reluctant to take on new species because of the lack of information available regarding the common diseases encountered and their management. Knowledge of these diseases will help clinicians to make a diagnosis and suggest appropriate treatment and this is the first retrospective study that presents the treatment results and prognosis of traumatic injuries in roe deer.

MATERIAL and METHODS

Twenty roe deer were presented to the Department of Surgery, Faculty of Veterinary Medicine, Ondokuz Mayıs University, Samsun, over a 4-year period (2004 to 2008) for evaluation of traumatic injuries on different parts of the body. Information collected from medical records included their gender, age, date of admission, second opinion versus primary care, diagnosis and discharge status (alive, euthanized or death).

Prior to examination, the roe deer were sedated with xylazine HCl (Rompun®, Bayer, Istanbul, Turkey, 1.1 mg/kg BW). Anesthesia was induced with intravenous administration of diazepam (Diazem®-Deva, Istanbul, Turkey, 0.2 mg/kg BW) and ketamine HCl (Ketasol®, Richterpharma, Interhas, Ankara, Turkey, 1.1 mg/kg BW) combination. Afterward, they were intubated and anesthesia was maintained with isoflurane (Forane®, Abbott, India, 2-3%) and O2 (2.5-3%). The deer were then evaluated clinically and radiographically *(Table 1).*

RESULTS

Duration of the fractures or injuries at the time of presentation varied from 12 hour to 5 days. The animals ranged in weight from 1.8 kg to 22 kg (mean: 13.94kg). Eight were female (4 adults and (4 fawn <1 yrs) and twelve were males (9 adults and (3 fawn <1 yrs). June, July and November were the months when the highest numbers (17 cases) of roe deer were admitted.

Information regarding to all the animals are presented in *Table 1*. The most common diagnosis was fractures, which were seen mostly as of the long bone (n=8) fractures. Distribution of the fractures were femur (n=4), tibia (n=1), metacarpus and metatarsus (n=3). Other lesions involved a 11th thoracal vertebral fracture (n=1), coxa-femoral luxation and hip fracture (n=2) *(Fig. 1, 2)* and hock joint luxation (n=2) *(Fig. 3)*, phalangeal dislocation and tendon of musculus interosseus medius, superficial with deep common digital flexor tendon, and lateral with long digital extensor muscle tendon rupture (n=1). Most fractures (n=7) were open, displaced and nonarticular and 2 fractures were closed.

The remaining 6 animals had soft tissue injuries. Corneal erosion, infected bite wound on perianal region and pyelonephritis, bite wound and hypovolemic shock, internal bleeding including hypovolemic shock, abscess on thorax and hernia inguinalis, and open wounds on the right knee were detected. Emergency medical treatment were underwent in these animals [13-15].

Of the 20 admitted, 14 (70%) were treated, 4 (20%) were euthanized and 2 (10%) died without treatment. Of the 14 that were treated, 7 (50%) were died 1 to 5 days after operation, and the other 7 (50%) were discharged alive. As a result, 7 animals were discharged from the hospital and all were doing well at follow-up, 2 months to 4 years after discharge.

The case of 15, 16, 18 and 19 were in phase of agony when they had been brought to the clinic. So euthanasia was performed to these cases.

Table 1. *Information about 20 roe deer admitted from 2004 to 2008 and the results of treatment administered*

Tablo 1. *2004-2008 tarihleri arasında getirilen 20 karaca hakkındaki bilgiler ve sağaltım* sonuçları

Case No	Signalment	Month of Presentation	Time of Presentation	Sedation Before Transportation	Fracture / Injuries Site	Treatment	Time to Recovery
1	Adult, male (17 kg)	May	2 days	No sedation	Corneal erosion	Cebemyxine® (Neomycine sulfate + polymyxin sulfate) and Cebedex® (dexamethasone), 3 times daily, 2 drops; during 21 days long	3 weeks (recovered)
2	Fawn <1 yr old female (5 kg)	Nov.	1 day	Sedation	Femoral fracture (R) (Open, fragmented, infected)	Amputation from level of the proximal one third of the femur	2 weeks (recovered)
3	Adult, female (15 kg)	Jun.	3 days	No sedation	Fractures of ilium, ischium, pubis and femur, and sacroiliac dislocation (L)	The ilial fracture was treated with 8-holed pelvic reconstruction and 4-holed neutralization bone plate. Two cortical screws were used for fixation of the sacroiliac dislocation	Died, one day later
4	Fawn <1 yr old male (2.5 kg)	Jun.	12 hours	Sedation	Metacarpal fracture (L) (open, diaphyser)	A splint was applied on metacarpus to provide immobilization	3 weeks (recovered)
5	Adult, female (17 kg)	Jun.	2 days	No sedation	Infected bite wound on perianal region and pyelonephritis	The wound was cleaned by flushing with sterile saline solution and Rifamycin (Rifamp amp®). The drain was applied to wound and then sutured. Oxytetracycline (2.5 mg/kg IV q 24 h) was used for treatment of pyelonephritis	Died, 3 days after operation
6	Adult, female, pregnant (19 kg)	Dec.	5 days	No sedation	Bite wound, hypovolemic shock	The wound was cleaned by flushing with sterile saline solution and Rifamycin (RiFamp amp®). The drain was applied to wound and then sutured. Ringer lactate solution (15 ml/kg IV q 24h) and oxytetracycline (2.5 mg/kg IV q 24 h) were used for treatment of hypovolemic shock	Died, one day later
7	Adult, male (22 kg)	Feb.	1 day	No sedation	Internal bleeding including hypovolemic shock	No treatment	Died
8	Fawn <1 yr old female (3.0 kg)	Nov.	3 days	No sedation	Femoral fracture (L) (Closed, diaphyser, transversal)	6-holed neutralization bone plate was used for treatment of femur fracture	Died, 2 days after operation
9	Fawn <1 yr old female (5 kg)	Jul.	2 days	No sedation	Metacarpal fracture (R) (open, diaphyser, oblique) and abscess on femoral region	6-holed neutralization bone plate was used for treatment of metacarpal fracture. The routine abscess treatment was perfomed	Died, one week later
10	Adult, male (21.5 kg)	Jun.	3 days	No sedation	Tarso-metatarsal luxation (L)	Bilateral type-II acrylic external fixator was applied in transarticular fashion	Died, 5 days after operation

(L): Left, (R): Right, Feb.: February, Jun.: June, Jul.: July, Nov.: November, Dec.: December

Table 1. *(Continued)*
Tablo 1. *(Devam)*

Case No	Signalment	Month of Presentation	Time of Presentation	Sedation Before Transportation	Fracture / Injuries Site	Treatment	Time to Recovery
11	Adult, male (22 kg)	Jul.	18 hours	Sedation	Tarso-metatarsal luxation and metatarsal fracture (L), open wounds	Disarticulation from level of the tarso-metatarsal joint	3 weeks (recovered)
12	Fawn <1 yr old female (10 kg)	Nov.	4 days	No sedation	Open tibial fracture (R) and, bite wound on cervical and hip region	No treatment	Died
13	Fawn <1 yr old male (12 kg)	Nov.	1 day	Sedation	Metatarsal fracture (L) (open, fragmented)	Amputation at the level of the distal one third of the metatarsus	3 weeks (recovered)
14	Adult, male (20 kg)	Jul.	1 day	Sedation	Acetabular fracture (R) and, hip luxation (L)	Excision of femoral head and neck	4 weeks (recovered)
15	Adult, male (21 kg)	Jul.	2 days	Sedation	11th thoracal vertebral fracture	No treatment	Euthanasied
16	Adult, male (16 kg)	Jul.	1 day	No sedation	Bilateral phalangeal dislocation and tendon rupture	No treatment	Euthanasied
17	Adult, female (19 kg)	Jun.	2 days	Sedation	Abscess on thorax and, hernia inguinalis	Ringer lactate solution (15 ml/kg IV q 24 h) and oxytetracycline (2.5 mg/kg IV q 24h) were used for treatment. The routine abscess treatment was perfomed	Died, the same day
18	Adult, male (22 kg)	Jun.	1 day	No sedation	Coxa-femoral luxation (R) and, rupture of cranial cruciate ligament and hypovolemic shock	No treatment	Euthanasied
19	Adult, male (18 kg)	Jul.	1 day	Sedation	Infected multiple fractures of long bones (open)	No treatment	Euthanasied
20	Fawn <1 yr old male (1.8 kg)	Jun.	12 hours	Sedation	Open wounds on the right knee	The wound was cleaned by flushing with sterile saline solution and Rifamycin (Rifamp amp.®). The drain was applied to wound and then sutured.Oxytetracycline (2.5 mg/kg IV q 24h) was used for treatment	1 week (recovered)

(L): Left, (R): Right, Feb.: February, Jun.: June, Jul.: July, Nov.: November, Dec.: December

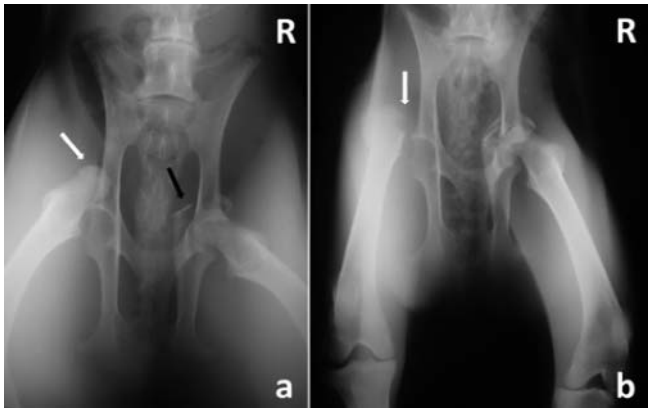

Fig 1. ***(a)*** Left craniodorsal hip luxation (white arrow) and right stable acetabular fracture (black arrow) in preoperative pelvic radiograph of case no: 14, ***(b)*** Pelvic radiograph after femoral head ostectomy (white arrow) on postoperative 1st week

Şekil 1. ***(a)*** Olgu no: 14'ün preoperatif pelvis radyografisinde sol kraniodorsal kalça çıkığı (beyaz ok) ve sağ stabil asetabular kırık (siyah ok), ***(b)*** Postoperatif 1. haftada kaput femoris ostektomisinin (beyaz ok) ardından çekilen pelvis radyografisi

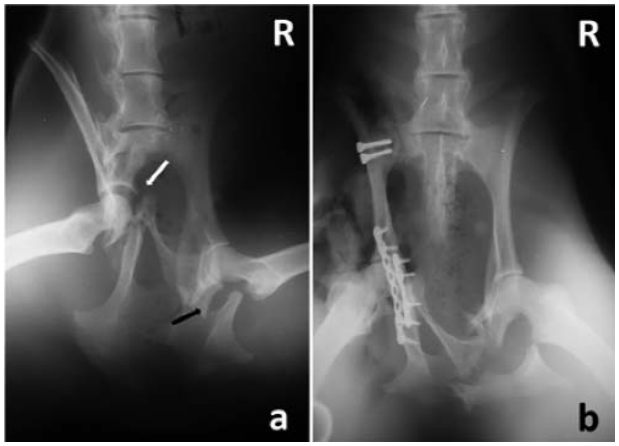

Fig 2. ***(a)*** Left comminuted acetabular fracture (white arrow) with sacro-iliac luxation and right ischial fracture (black arrow) in preoperative pelvic radiograph of case no: 3, ***(b)*** Fixation with two bone plate and interfragmental lag screw application on pelvic radiograph immediately after the operation

Şekil 2. ***(a)*** Olgu no:3'ün preoperatif pelvis radyografisinde parçalı sol asetabulum kırığı (beyaz ok) ile sakroiliak ayrılma ve sağ os ishium kırığı (siyah ok), ***(b)*** Operasyondan hemen sonra çekilen pelvik radyografide iki plak ve interfragmental lag vidası ile yapılan fiksasyon

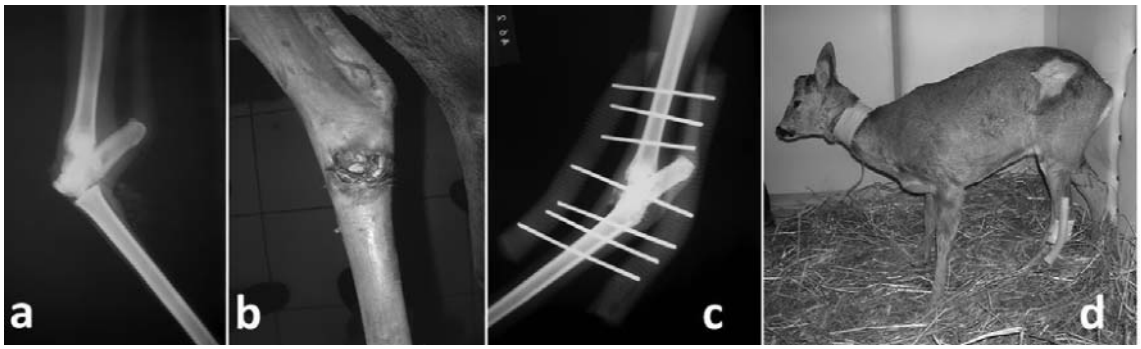

Fig 3. ***(a)*** Medio-lateral radiography (note the 90° malposition in horizontal plane) and ***(b)*** clinical view of case no: 10 with open hock joint luxation and concurrent severe collateral ligament rupture, ***(c)*** Mediolateral radiography and ***(d)*** clinical view of the case after fixation with bilateral type-II acrylic external fixator in transarticular fashion

Şekil 3. ***(a)*** Olgu no: 10'da açık topuk eklemi çıkığının ***(a)*** medio-lateral radyografisi (horizontal düzlemdeki 90°'lik malpozisyona dikkat) ve ***(b)*** klinik görünümü. Olgunun bilateral tip-II akrilik eksternal fiksatör ile transartiküler fiksasyonunun ardından ***(c)*** medio-lateral radyografisi ve ***(d)*** klinik görünümü

DISCUSSION

As with in any retrospective case series, this study has limitations. Most importantly, the occurrence of these afflictions and their frequency may not reflect the perceptions of farmers working in their fields as simple cases capable of being treated by them without veterinary assistance. However, the data are likely to be helpful to veterinarians called to treat sick roe deer, as the cases described here are presented for this reason.

The proportion of young animals admitted to the clinic, probably explains why the months with the highest caseloads were June, July and November. Calving in roe deer occurs in May and June, as this period encompasses the neonatal to weaning and rutting periods. Fractures and other musculoskeletal problems were other conditions that young roe deer were disposed to, especially during the late summer and early fall growing stages. Fractures seen were mostly as traumatic catastrophic comminuted long bone fractures in young as well as young adult roe deer. Fractures are most likely due to the increased fighting among the animals associated with the onset of the rutting season in July and August [16,17]. Fractures and other musculo-skeletal problems were predominant (70%) compared to those affecting soft tissue (30%).

Stress in the animals is usually caused by excesssive muscular exertion or fear during their capture, loading or transportation. The many unfamiliar events that occur during transportation leads to both psychological stress as well as the accompanying physical stress of muscular exertion. This excessive muscular exertion may result in damage to locomotor, respiratory or heart muscles, resulting in capture myopathy (or exertional rhabdomyolysis). In ungulates, the syndrome is characterised clinically by depression, muscular stiffness, lack of coordination, paralysis, metabolic acidosis and death [2,4,18,19].

Of the 14 roe deer treated, 7 (50%) were not sedated and 7 (50%) were sedated during transportation. Seven animals were discharged alive after operation but seven others died 24 h, 48 h and between 3 and 7 days after operation. They probably died from shock caused by the fractures, muscle damage, and subsequent hemorrhage or because of delayed acute capture myopathy [6]. According to present authors' clinical experience, mortality rate could be less if all cases were sedated at the time of initial capture.

Six roe deer discharged alive after the operations which were sedated before and during transportation. Only one roe deer was not sedated. Sedative drugs are useful for reducing stress response and preventing adverse effects of stress [2]. It is essential to minimise stress factors for a successful postoperative rehabilitation period.

The mortality rates of injured roe deer may reduce as veterinarians become more adept at treating such cases. This study is intended to further improve prognosis of roe deer by making veterinarians aware of the common problems of these animals, and facilitate their timely sedation and treatment.

It was concluded that, sedative injection before transportation for 6 of the 7 discharged Roe deer minimised the stress factors. According to the present authors' clinical experience, administration of sedative injection is very essential for the survival rate of Roe deer in the postoperative and rehabilitation period.

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