

A Retrospective Study on Pelvic Fractures in Cats and Dogs (2020-2022)

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ABSTRACT

Pelvic fractures occur in many traumas in cats and dogs. In this study, it was aimed to evaluate the treatment (conservative and operative) and its results together in cats and dogs diagnosed with pelvic fracture. The study material consisted of 223 pelvic fractures (15 acetabulum, 40 ischia, 68 ilium, 38 pubis and 62 sacroiliac separation) detected in 27 dogs and 75 cats of different ages, breeds and genders between 2020-2022. Pelvic fracture was diagnosed with clinical and radiological examination. It was treated conservatively and operatively (using iliosacral screw, iliosacral pin, locking plate, cerclage, acetabular C plate). It was observed that cases with pelvic fractures were mostly caused by falling from a height in cats and traffic accidents in dogs. It was also observed that there could be a single fracture in the pelvis as well as multiple fractures. A total of 73 cases were operated. In 55 of the fractures, iliosacral screw, 1 iliosacral pin, 45 locked plate, 9 cerclage application, 10 acetabular C plate and 1 excision arthroplasty were applied. Conservative treatment was applied to 29 cases. No complications were observed in the controls performed in the operated patients. It was concluded that good results were obtained in stabilization with screws in cases of sacroiliac separation, and the use of locking plates in ilium fractures and the use of acetabular C plate in acetabulum fractures could lead to a more comfortable and comfortable postoperative period.

Key words: Acetabular C plate, cats, dogs, locking plate, pelvic fractures

Kedi ve Köpeklerde Kalça Kırıkları Üzerine Retrospektif Bir Çalışma (2020-2022)

ÖZ

Kedi ve köpeklerde birçok travmada pelvik kırıklar meydana gelir. Bu çalışmada pelvik kırık tanısı konulan kedi ve köpeklerde tedavi (konservatif ve operatif) ve sonuçlarının birlikte değerlendirilmesi amaçlandı. Çalışma materyalini 2020-2022 yılları arasında farklı yaş, cins ve cinsiyetteki 27 köpek ve 75 kediye tespit edilen 223 pelvik kırık (15 asetabulum, 40 ischi, 68 ilium, 38 pubis ve 62 sakroiliak ayrılma) oluşturmuştur. Pelvis kırığı tanısı klinik ve radyolojik muayene ile konuldu. Konservatif ve operatif olarak (iliyosakral vida, iliosakral pin, kilitli plak, serklaj, asetabular C plak kullanılarak) tedavi edildi. Pelvik kırık vakalarının kedilerde en çok yüksekten düşme, köpeklerde ise trafik kazası sonucu meydana geldiği görüldü. Pelviste tek kırık olabileceği gibi birden fazla kırık da olabileceği gözlemlendi. Toplam 73 vaka ameliyat edildi. Kırıkların 55'ine iliosakral vida, 1'ine iliosakral pin, 45'ine kilitli plak, 9'una serklaj uygulaması, 10'una asetabular C plak ve 1'ine eksizyon artroplastisi uygulandı. 29 olguya konservatif tedavi uygulandı. Ameliyat edilen hastalarda yapılan kontrollerde herhangi bir komplikasyon görülmedi. Sakroiliak ayrılma durumlarında vidalarla stabilizasyonda iyi sonuçlar elde edildiği, ilium kırıklarında kilitli plak, asetabulum kırıklarında ise asetabular C plak kullanımının ameliyat sonrası dönemi daha rahat ve konforlu geçirebileceği sonucuna varıldı.

Anahtar kelimeler: Asetabular C plağı, kedi, köpek, kilitli plak, pelvik kırıklar

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INTRODUCTION

Pelvic fractures constitute at least 25% of all fractures seen in small animal practice, therefore they are important in traumatic injuries of dogs and cats (Olmstead 1998; Piermattei et al. 2006; Harasen 2007). The configuration of the pelvis, like a rectangular box, ensures that any trauma that would cause a fracture will result in multiple fractures. On the positive side, the major muscle groups around the pelvis provide significant natural stability to most fractures, often eliminating the need for surgical repair (Olmstead 1998; Denny and Butterworth 2000; Piermattei et al. 2006; Harasen 2007). Pelvic fractures often develop as a result of major traumas such as traffic accidents (Bouabdallah et al. 2020; Yurtal et al. 2022). One or both sacroiliac joints are usually luxated in animals exposed to posterior trauma. There is an associated sacral fracture or combinations of long, oblique fractures in one or both ilia. In animals exposed to side trauma, however, the femoral head may push towards the acetabulum, which may cause fracture of the ilium, pubis, and acetabulum (Olmstead 1998, Harasen 2007).

Most animals (75%) with pelvic fractures heal without surgery. The most common criteria for recommending surgical repair of a pelvic fracture are:

- Displaced acetabulum fractures, especially involving the 2/3 cranial of the acetabulum
- Narrowing of the pelvic canal by more than 1/3 of the diameter with fracture fragments;
- Neurological impairment including persistent pain attributable to fracture
- Ipsilateral fractures of the ilium, the ischium and pubis, resulting in an unstable hip joint (Olmstead 1998; Aksoy & Özsoy 2003; Harasen 2007; Meeson and Geddes 2015).

Conversely, minimally displaced fractures, fractures beyond the cranial 2/3 of the acetabulum, cases in which pain is well-managed, or fractures older than 7-10 days are often best treated with cage rest (Olmstead 1998; Bouabdallah et al. 2020; Bourbos et al. 2020; Harasen 2007).

The most common pelvic fractures for which surgery may be considered are sacroiliac luxations, iliac fractures, and acetabulum fractures (Aksoy and Özsoy 2003; Piermattei et al. 2006; Harasen 2007, Bourbos et al. 2020; Yurtal et al. 2022). Sacroiliac luxations or fractures are a source of pain and instability, and are the most common pelvic fracture associated with neurological deterioration (Piermattei et al. 2006; Harasen 2007; Meeson and Cor 2011; Sadan 2016). The fracture or dislocation causes craniodorsal displacement of the ilium. Surgical repair of bone screws can be performed (Zamirbekowa et al. 2021). The most common fractures of the pelvis are fractures of the ilium (46% of all pelvic fractures) (Olmstead 1998; Denny and Butterworth 2000; Altunatmaz et al.

2004; Piermattei et al. 2006; Harasen 2007; Meeson and Cor 2011; Zamirbekowa et al. 2021; Yurtal et al. 2022). These fractures are important in terms of narrowing the pelvic canal and causing trauma to the lumbosacral nerve trunk that branches into the sciatic nerve. Bone plate repair is the most common and successful method of surgical treatment (Olmstead 1998; Denny and Butterworth 2000; Altunatmaz et al. 2004; Piermattei et al. 2006; Harasen 2007; Meeson and Cor 2011; Yurtal et al. 2022).

In addition, surgical repair is indicated for fractures of the acetabulum. Surgical repair of acetabular fractures with bone plates or bone screws, interfragmentary wire can yield good clinical results if rigid fixation and anatomical reduction are provided. If surgical repair of the acetabulum is not possible, salvage procedures such as femoral head and neck osteotomy are performed (Piermattei et al. 2006).

In this study, it was aimed to evaluate the treatment (conservative or operative) and its results in cats and dogs with pelvic fractures brought to our hospital with various etiologies.

MATERIAL and METHODS

Medical records and radiographs of cats and dogs with pelvic fractures in Dicle University Veterinary Faculty Animal Hospital Surgery Clinic between 2020 and 2022 were reviewed. According to data obtained from medical records, gender, age, body weight, gender, and recovery status after surgical treatment were evaluated. The number and location of pelvic fractures were determined on preoperative lateral and ventrodorsal radiographs of the pelvis.

Surgical techniques were determined according to the size and location of the fracture. For sacroiliac luxation, stabilization of the sacroiliac joint was achieved with the application of one or two long cortical screws or a U-shaped percutan pin (Figure 1). Locking plates or wires were applied to stabilize the iliac fracture (Figure 2). Acetabular C plate was used for stabilization of acetabular fractures (Figure 3). Femoral head and neck osteotomy (FHO) was performed in cases where the caput femoris was fractured together with the acetabulum. Conservative treatment and cage rest were recommended for ischial or pubic fractures.

Postoperative clinical follow-up and evaluation of complications were based on two considerations. The first of these was related to the incision wound. The second was the evaluation of permanent lameness. The degree of lameness was scored from 0 to 4 (0= no lameness; 1= subtle lameness; 2= obvious lameness; 3= intermittent, non-weight-bearing lameness; 4= non-weight-bearing lameness) (Kim et al. 2011).

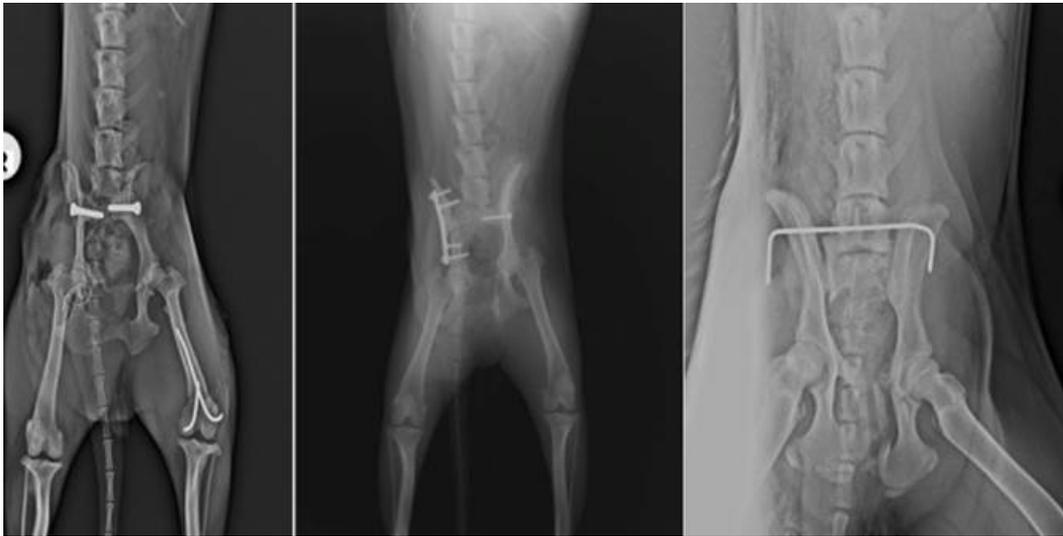


Figure 1: Sacroiliac separations. It is also possible to place one or two screws lateral to the sacroiliac joint. In addition, especially in bilateral cases, a pin passed percutaneously from the ala ossis ilium from the lateral side can be advanced until it emerges from the ala ossis ilium on the opposite side and placed in a U shape.



Figure 2: It is doubtful that the application of cerclage wire, which is passed through the holes drilled into the fragments in os ilium fractures, will provide adequate immobilization, but nail, plate and screw applications can also be performed depending on the localization of the fracture. In the study, plaque was applied in 45 cases and cerclage was applied in 5 cases. Functional improvement was achieved in both applications. However, it can be said that the decrease in the costs of vinyl with the developing technology in recent years has contributed to the widespread use of this practice.



Figure 3: Fractures in which the acetabulum is affected. The acetabulum is very important for the function of the coxofemoral joint, and the application of acetabular C plate is more recommended in order to avoid complications such as coxoarthrosis in fractures of the acetabulum that include the articular surface and have collapsed.

RESULTS

It was obtained from the registration information that among the total of 512 patients with trauma-induced orthopedic fractures in 2020-2022, the number of patients with pelvic fractures was 102 (19.92%). These pelvic fractures were reported in 27 dogs (26.47%) and 75 cats (73.52%). Body weights ranged from 12 kg to 60 kg in dogs and between 1.2 kg and 6.2 kg in cats. The average body weight is 23.03 kg for dogs and 2.4 kg for cats. The mean age of dogs at the time of fracture was 2.65 years (1 to 5 years) and 1.95 years (4 months to 5 years) in cats. 14 dogs (13.72%) and 46 cats (45.09%) were male, 13 dogs (12.74%) and 29 cats (28.43%) were female. In the clinical examination of dogs and cats, there were different degrees of lameness from grade 1 to grade 4.

While the cause of pelvic fractures in cats was falling from a height (n=69, 67.64%), traffic accident (n=4, 3.92%), unknown (n=2, 1.96%), it was observed that this condition occurred in dogs in a traffic accident (n=21, 20.58%) and the cause of unknown origin (n=6, 5.88%).

The distribution of the pelvic fractures of the cats and dogs included in the study and the treatments applied are summarized in table 1 and table 2. In this study, which was conducted on 75 cats and 27 dogs, 223 fractures were evaluated. Because more than one fracture was found in the pelvis of the same animal. In addition, there were patients with bilateral iliosacral separation (85.21% in cats, 76.92% in dogs) and bilateral iliac fractures (32.25% in cats, 13.33% in dogs).

Table 1. Pelvic fracture and treatment distributions of 75 cats

Fractures		Treatment selection	Operative	Conservative
Sacroiliac separations	39	Iliosacral screw	35 (19 cats)	4 (2 cats)
Ilium fractures	51	Locked plate	34 (29 cats)	14 (9 cats)
		Cerclage	3 (3 cats)	
Acetabulum	14	Acetabular C plate	10 (10 cats)	2 cats
		Other (Cerclage or excision arthroplasty)	2 (2 cats)	
Ischia	28	Cerclage	3 (3 cats)	25 (21 cats)
Pubic	27	-	-	27 (21 cats)
Total	159	87 fractures (54 cats)		72 fracture (21 cats)

An animal may have more than one fracture. Also, one animal had bilateral fractures.

Table 2. Pelvic fracture and treatment distributions of 27 dogs.

Fractures		Treatment selection	Operative	Conservative
Sacroiliac separations	23	Iliosacral screw	19 (11 dogs)	2 (1 dog)
		U pin	2 (1 dog)	
Ilium fractures	17	Locked plate	11 (9 dogs)	4 (4 dogs)
		Cerclage	2 (2 dogs)	
Acetabulum	1	Cerclage	1 (1 dog)	-
Ischia	12	-	-	12 (8 dogs)
Pubic	11	-	-	11 (7 dogs)
Total	64	35 fractures (19 dogs)		29 fracture (8 dogs)

An animal may have more than one fracture. Also, one animal had bilateral fractures.

In cases with a single fracture, patients were discharged on the same day, while patients with multiple fractures were discharged a day later after being checked. Discharge time for both cats and dogs who underwent unilateral surgery was significantly shorter than those with multiple fractures or bilateral surgery. No implant-related complications were observed in any of the pelvic fractures in cats and dogs, or a second surgery was not required.

Among the cases, complications such as blood in urine and feces were seen in 20 cats (26.6%) and 7 dogs (25.9%) immediately after trauma, but all of them recovered. At the initial evaluation, 3 cats (4%) and 1 dog (3.7%) had neurological symptoms and recovered. Among the postoperative complications, local symptoms such as accumulation of surgical site serosity and opening of the sutures were observed in 12 cats (%16) and 3 dogs (%11). 5 cats (%6.66) with iliac fractures showed signs of paralysis in the relevant leg, but these symptoms disappeared spontaneously 15 days after the operation. Such a situation was not observed in dogs.

Femoral head resection was performed in 1 cat with displaced ilium and acetabulum fractures, but constipation developed in the 4th postoperative month and megacolon developed in the following period.

Among the cases with sacroiliac separations, those who were fixed with screws started pressing the next day and their lameness scores were 0 at the end of the first postoperative week. In iliac and acetabulum fractures, the healing was better in plate-fixed cases, but the same was not possible in wire-placed cases. It took 2 months for the lameness score to be "0" in 1 cat who developed paralysis with only iliac fracture. In cases who received conservative treatment, it took 2 or 3 weeks to be "0" according to the lameness score.

Despite functional improvement in all cases, permanent lameness remained in 2 dogs (one case in which a cerclage wire was applied to the ilium and another case with multiple fractures treated conservatively). It was seen at the end of the 4th month that all the cats recovered.

DISCUSSION

Pelvic fractures are frequently encountered in cats and dogs. These fractures, which make up about 25% of all fractures in small animals, affect cats and dogs of all ages, but this mostly occurs in young people (Kim et al. 2011; Gant and Asztalos 2019; Arıcan (a) 2019; Arıcan (b) 2019; Bourbos et al. 2020). In this study, pelvic fractures constituted approximately 19.92% of all fracture cases encountered during the two-year period of the study. The age population in previous studies is similar to our study. Because both the active state of young cats or dogs during their walks and their inexperience are thought to be effective.

In previous studies (Aksoy and Özsoy 2003; Altunatmaz et al. 2004; Kim et al. 2011; Sağlam et al.

2016; Bouabdallah et al. 2020; Leffman and Prittie 2022), it has been reported that the etiology of pelvic fractures is generally caused by falling from a height in cats and traffic accidents in dogs. In our study, similar results were obtained in previous studies. It was determined that 67.64% of all cases occurred as a result of falling from a height in cats, and 20.58% occurred as a result of traffic accidents in dogs. In this case, it can be said that the problem of cats falling from heights contributes significantly to pelvic fractures.

The first two common causes of pelvis fractures are falls from height and traffic accidents (Altunatmaz et al. 2004; Hammer et al. 2019; Bouabdallah et al. 2020). They are also a cause of trauma. Therefore, trauma management should be considered, and the vital values necessary to keep the animal alive should be constantly monitored. In addition to the evaluation of the respiratory system and cardiovascular system, neurological functions should be followed up. In addition, the patient should be followed up as a whole, especially in terms of thoracic trauma and urinary system trauma (Meeson and Cor 2011; Kim et al. 2011; Sadan et al. 2016; Gant and Asztalos 2019; Parlak et al. 2021).

Treatment should be planned surgically in sacrum fractures, ilium fractures and 2/3 cranial part (weight bearing region) fractures of the acetabulum, displaced fractures that cause 50% or more narrowing of the pelvic canal (Meeson and Geddes 2015; Arıcan (a) 2019; Arıcan (b) 2019). The surgical procedure varies according to the location and type of fracture. Appropriate implant selection and correct reduction of anatomical placement are associated with a favorable prognosis after surgery (Kim et al. 2011; Arıcan (a) 2019; Arıcan (b) 2019). Conservative treatment is considered when a fracture occurs in the pubis, ischia or caudal 1/3 of the acetabulum (Arıcan (a) 2019; Arıcan (b) 2019; Hammer et al. 2019). In our study, the cases were selected by considering these considerations while planning the surgery. In this study, fixation with a cerclage wire was provided in some of the cases where surgery was recommended due to the financial burden of the owner, but the wire alone never provided an adequate fixation. For this reason, a more comfortable postoperative period was passed in fractures where plate was applied.

In sacroiliac separations, repair failure may occur if the screw length is too short or the screw is applied suboptimally. Screw migration has been reported in some studies (Meeson and Cor 2011; Kim et al. 2011; Hammer et al. 2019). In our study, no complications related to screw applications were observed in cases of sacroiliac separation. In addition, these patients had better postoperative comfort than others. In our study, "U pin application" was performed percutaneously in a dog weighing 60 kg and it was observed that this dog recovered with a lameness score of "0". It can be said that sacroiliac separations are more comfortable than other fractures of the pelvis.

Acetabulum fractures are more difficult among pelvic fractures and implant failure and bone fragment displacement can be seen as a complication in these fractures. The acetabular C plate application has found application for this type of fracture (Arıcan (a) 2019; Arıcan (b) 2019). We also used the acetabular C plate in our study and had excellent results. The postoperative comfort of the patients was very good, including their gait. In only 1 cat, the acetabulum was fixed with a cerclage wire due to C plate incompatibility. And although this patient recovers functionally, the result is doubtful because if a fully compatible joint cannot be achieved in terms of osteoarthritis, it is always risky in the long term. Blood in the urine and stool can be seen in hip fractures. Trauma follow-up should be performed in these patients. Sometimes constipation is also possible. Bowel movements of a patient who cannot walk normally are also affected. In addition, if there is a narrowing in the pelvic canal, the colon is adversely affected (Kim et al. 2011; Kipfer and Montavon 2011; Meeson and Geddes 2015; Pinna et al. 2021). In one of the cat cases, which underwent excision arthroplasty and planned conservative treatment, constipation was observed at the beginning of the postoperative period and megacolon development 4 months later, although the pelvic canal did not completely narrow. Therefore, in cases where the pelvic canal is affected, a good reduction and fixation must be ensured. It is known that the sciatic nerve may be affected, especially in ilium fractures (Meeson and Cor 2011; Zamirbekova et al. 2021). Some of our cases had neural symptoms associated with the ilium fracture and these disappeared spontaneously, but a cat with a unilateral ilium fracture gave neurological symptoms after plaque placement. This situation was alarming, but after a while this situation disappeared.

CONCLUSION

As a result, we think that good results are obtained in stabilization with screws in sacroiliac separation cases for pelvic fractures, the use of locking plate in ilium fractures gives more effective results and the use of acetabular C plate for acetabular fractures contributes to the postoperative process significantly. In addition, conservative treatment may be considered for ischial and pubic fractures with fractures for which surgery is not indicated.

Conflict of Interest: No potential conflict of interest was reported by the authors.

Authorship Contributions: EÇ, SY, SA and BEK conceived and supervised this study. EÇ, SY, SA, BEK, NS and ŞH collected and analyzed data. EÇ wrote the first draft of manuscript. All authors

contributed to the critical revision of the manuscript and have read and approved the final version.

Ethical Approval: The study protocol was approved by the Dicle University Health Sciences Application and Research Center Local Ethics Committee (E-35582840-020-303463).

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REFERENCES

- Aksoy, Ö., & Özsoy, S. (2003).** Treatment of Ossa Coxae Fractures and Related Complications in Cats and Dogs and Clinical Evaluation of Late Period Results. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, 9(2):187-202.
- Altunatmaz, K., Aksoy, Ö., Özsoy, S. (2004).** Radiographic evaluation of ossa coxae fractures and other orthopaedic lesions, occurring simultaneously in dogs and cats (1992-2002): 621 cases. *Istanbul Üniversitesi Veteriner Fakültesi Dergisi*, 30(1): 1-9.
- Arıcan, M. (2019) (a).** Pelvis kırıklarının değerlendirme kriterleri nelerdir? Kafes istürati mi? Cerrahi mi? *KHVHD Uluslararası Sürekli Eğitim Kongresi*. 8-10 Kasım, İstanbul.
- Arıcan, M. (2019) (b).** Pelvis kırıklarına cerrahi yaklaşımlar. *KHVHD Uluslararası Sürekli Eğitim Kongresi*. 8-10 Kasım, İstanbul.
- Bouabdallah, R., Meghrief, F., Azzag, N., Benmohand, C., Zenad, W., Rebouh, M. (2020).** Conservative management of pelvic fractures in dogs and cats in Algiers: Incidence and long-term clinical outcomes, *Veterinary World*, 13(11): 2416-2421. <https://doi.org/10.14202/vetworld.2020.2416-2421>.
- Bourbos, A., Cinti, F., Sergiampietri, F., Pisani, G. (2021).** The Use of Intraoperative Skeletal Traction for the Repair of Pelvic Fractures: An Experimental Cadaveric Study. *Vet Comp Orthop Traumatol*, 34 (2): 79-84. <https://doi.org/10.1055/s-0040-1716434>.
- Denny, H. R., Butterworth, S. J. (2000).** A Guide to Canine and Feline Orthopedic Surgery, 4th ed. Oxford: Blackwell Sci, 441-454, ABD.
- Gant, P., Asztalos, I. (2019).** Retrospective evaluation of factors influencing transfusion requirements and outcome in cats with pelvic injury (2009-2014): 122 cases. *J Vet Emerg Crit Care*, 1-6. <https://doi.org/10.1111/vec.12852>.
- Hammer, M., Gutbrod, A., Sigrist, N. E., Jacot, V., Del Chicca, F., Evans, R., Pozzi, A. (2019).** Predictors of comorbidities and mortality in cats with pelvic fractures. *Vet Surg*, 1-10. <https://doi.org/10.1111/vsu.13369>.
- Harasen, G. (2007).** Pelvic fractures. *Can Veterinary J*, 48, 427-428.
- Kim, K. H., Lee, J. H., Yoon, H. Y., Jeong, S. W. (2011).** Clinical analysis of pelvic fracture in 54 dogs. *J Vet Clin*, 28 (5): 467-472.
- Kipfer, N. M., Montavon, P. M. (2011).** Fixation of pelvic floor fractures in cats. *Vet Comp Orthop Traumatol*, 2: 1-5. <https://doi.org/10.3415/VCOT-09-12-0129>.
- Lefman, S., Prittie, J. E. (2022).** High-rise syndrome in cats and dogs. *J Vet Emerg Crit Care*, 32 (5): 571-581. <https://doi.org/10.1111/vec.13206>.

- Meeson, R. L., Geddes, A. T. (2015).** Management and long-term outcome of pelvic fractures: a retrospective study of 43 cats. *Journal of Feline Medicine and Surgery*, 1-6. <https://doi.org/10.1177/1098612X15606958>.
- Meeson, R., Cor, S. (2011).** Management of pelvic trauma. Neurological damage, urinary tract disruption and pelvic fractures. *Journal of Feline Medicine and Surgery*, 13: 347–361. <https://doi.org/10.1016/j.jfms.2011.03.011>.
- Olmstead, M. L. (1998).** The pelvis and sacroiliac joint. In: Coughlan A, Miller A (Eds). *Manual of Small Animal Fracture Repair and Management*. Cheltenham: Br Small Anim Vet Assoc, 217–219, England.
- Parlak, K., Zamirbekova, N., Uzunlu, E. O., Akyol, E. T., Yavru, N. (2021).** Comparison of the Focused Assessment with Sonography for Trauma Protocol and Animal Trauma Triage Scoring System in Traumatized Dogs. *Kafkas Univ Vet Fak Derg*, 27 (4): 439-444. <https://doi.org/10.9775/kvfd.2021.25457>
- Piermattei, D. L., Flo, G. L., DeCamp, C. E. (2006).** *Handbook of Small Animal Orthopedics and Fracture Repair*, 4th ed. St. Louis: Saunders, 433–460, USA.
- Pinna, S., Tassani, C., Rossini, M., Lanzi, F. (2021).** External fixator for the treatment of narrowed pelvic canal in a cat. *Vet Med-Czech*, 66, 356–362. <https://doi.org/10.17221/173/2020-VETMED>
- Sadan, M. A., Amort, K., Kramer, M. (2016).** Pelvic floor fractures in 55 dogs and 39 cats: Ct and X- ray findings. *International Journal of Veterinary Sciences Research*, 2 (1):1-7. <https://doi.org/10.18488/journal.110/2016.2.1/110.1.1.7>
- Sağlam, M., Yüksel, Çalık, E. (2016).** Clinical and radiological evolution of traumatic lesions on the pelvis and hip joint in cats. *Vet Hekim Der Derg*, 87 (1): 34-43.
- Yurtal, Z., Deveci, M. Z. Y., Alakuş, İ., Kırgız, Ö., Alakuş, H., İşler, C. T., Altuğ, M. E. (2022).** Prevalence of pelvic fractures in cat and dogs: A retrospective study in 183 cases (2016-2020). *J Adv VetBio Sci Tech*, 7 (1): 109-114. <https://doi.org/10.31797/vetbio.981133>
- Zamirbekova, N., Uzunlu, E. O., Özdil, B., Arıcan, M. (2021).** Clinical and radiological comparison of the application of bone plates on the lateral and dorsal side of the os ilium in the treatment of corpus ossis ilium fractures in cats. *Eurasian J Vet Sci*, 37 (1): 32-40. <https://doi.org/10.15312/EurasianJVetSci.2021.323>