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Retrospective evaluation of pelvic fractures in cats: 144 cases (2018-2023)

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ABSTRACT

Objective: This study aims to examine pelvic fractures in cats brought to the Siirt University Animal Health and Research Hospital between 2018 and 2023.

Materials and Methods: Using a retrospective design, the study analyzed data from 144 cats.

Results: The data revealed that pelvic fractures generally occurred as a result of traumatic events such as motor vehicle accidents and falls from heights. Of the 259 fracture cases studied, it was determined that 24.32% were pubic fractures, 23.54% were sacroiliac separations, 19.69% were ischial fractures, 12.74% were ilial fractures, 10.42% were symphysis pelvis separations, 7.72% were acetabular fractures, and 1.54% were sacral fractures. Patients in the study were treated conservatively or operatively (using methods such as iliosacral screws, acetabular C plates, locked plates, cerclage wires, and dorsal laminectomy).

Conclusion: In conclusion, operative treatment plays a significant role in the management of pelvic fractures, and the suitability of surgery should be carefully evaluated. Clinical outcomes indicated that cats undergoing operative treatment achieved more favorable results and higher discharge rates.

Keywords: *Feline, Pelvic fractures, Iliosacral screw, Cerclage wires, Locked plates*

INTRODUCTION

The complex structure of the Os coxae consists of three separate bones. The ilium is located craniodorsally, the pubis is located cranioventrally, and the ischium is located caudoventrally. The Os coxae are formed by the fusion of the pubis and ischium at the midline of symphysis pelvis (Dursun, 2008; Bahadır and Yıldız, 2010).

Pelvic fractures in cats are commonly associated with motor vehicle accidents, falls from heights, blunt force trauma, gunshot wounds, and attacks by other animals such as dogs (Bookbinder and Flanders, 1992; Meeson and Geddes, 2017; Bourbos et al., 2020; Yurtal et al., 2022; Çatalkaya et al., 2024). Rarely, fractures in this region can also occur due to factors like neoplastic lesions and compression (Bookbinder and Flanders, 1992; Yurtal et al., 2022; Çatalkaya et al., 2024). Pelvic fractures account for approximately 20% to 30% of all fracture cases in cats (Altunatmaz et al., 2004; Draffan et al., 2009; Sadan et al., 2016). Among pelvic fractures, the most common are fractures of the pubis, which forms the pelvic floor, followed by sacroiliac luxations (Bookbinder and Flanders, 1992; Aksoy and Özsoy, 2003; Sadan, 2016).

Due to the anatomical structure of the pelvis, trauma can result in multiple fractures. Additionally, the major muscle groups in the region provide extra stability to the pelvic bones (Piermattei and Johnson, 2004; Harasen, 2007; Çatalkaya et al., 2024). Treatment of pelvic

fractures can involve operative intervention, cage rest, and medical management, taking into account various factors (Altunatmaz et al., 2004; Çatalkaya et al., 2024). Surgical intervention is recommended within 48-72 hours to minimize the risk of early fibrous union and muscle contraction. However, it is crucial to carefully assess the patient's condition during this period to determine suitability for surgery (Piermattei and Johnson, 2004; DeCamp, 2016).

Pelvic fractures have been successfully treated using various osteosynthesis materials in operative interventions (Bookbinder and Flanders, 1992; Altunatmaz et al., 2004; Schmierer et al., 2015; DeCamp, 2016). Methods such as two iliosacral lag screws and combinations of iliosacral screws with intramedullary pins are utilized for sacroiliac luxations (DeCamp, 2016). Plate osteosynthesis is predominantly used in the treatment of ilium fractures (Altunatmaz et al., 2004; Langley-Hobbs et al., 2009; DeCamp et al., 2016; Scrimgeour et al., 2017), while pins and compression screws (DeCamp et al., 2016) and T plates (Scrimgeour et al., 2017) can also be applied. For sacrum fractures, dorsal laminectomy, tail amputation, and pin and screw applications are employed (Smeak et al., 1985). Conservative treatment is typically preferred for pubis and ischium fractures (Tomlinson, 2003; DeCamp, 2016). During the conservative treatment of pelvic fractures, appropriate cage rest is applied at suitable intervals, and practices such as adequate bedding, local massage, and repositioning of the patient are crucial in preventing wound formation. Additionally, regular monitoring of urination and defecation, assessment of nerve damage, and management of additional injuries are necessary (Arıcan, 2019a).

The aim of this study was to retrospectively evaluate pelvic fractures diagnosed and treated in cats brought to Siirt University Animal Health Application and Research Hospital between 2018 and 2023.

MATERIALS and METHODS

This study retrospectively evaluated 144 cats diagnosed with pelvic fractures based on clinical and radiological examinations at Siirt University Animal Health Application and Research Hospital between 2018 and 2023. Data included demographic information such as age, breed, gender, and weight of the patients, along with the etiology and localization of the identified pelvic fractures. Treatment options applied were also assessed within this context.

In the study, the etiology of fractures was classified as traffic accidents, falls from height, and unknown causes. The localization of fractures was categorized as symphysis pelvis separation, acetabular fracture, sacroiliac separation, ilium fracture, ischium fracture, pubis fracture, and sacrum fracture. Treatment options were evaluated as operative and conservative.

Ethical approval

This study was approved with the decision of the Local Ethics Committee of Animal Experiments at Siirt University, dated 31/05/2024, and numbered 2024/05/30.

RESULTS

During the study period, out of 1524 cats brought to Siirt University Animal Health Application and Research Hospital for diagnosis and treatment purposes, pelvic fractures were diagnosed in 144 (9.44%) cases. The annual distribution of cases during the study period revealed that 12.6% (n=18) were diagnosed in 2018, 29.2% (n=42) in 2019, 15.2% (n=22) in 2020, 20.2% (n=29) in 2021, 12.6% (n=18) in 2022, and 10.5% (n=15) in 2023.

Of the 144 cats included in the study, 57.6% (n=83) were male and 42.4% (n=61) were female. The age of the cats ranged from 20 days to 2 years, with a mean age of 13.1 months determined. Among the cats, 59.02% (n=85) were in the age range of 0-1 year, 33.33% (n=48) were in the age range of 1-2 years, and 7.63% (n=11) were older than 2 years. The majority of cats, 87.5% (n=126), were mixed breed, while 5.5% (n=8) were British Shorthair, 4.86% (n=7) were Scottish Fold, and 0.69% (n=1) each were Van cat, Ankara cat, and Persian cat.

Upon evaluating the etiology of cases, it was found that 65.97% (n=95) were attributed to traffic accidents, 29.16% (n=42) to falls from height, and 4.86% (n=7) to trauma of unknown origin.

In 144 cats diagnosed with pelvic fractures, a total of 259 fractures were identified. Specifically, fractures included pubic fractures in 24.32% (n=63) of cases, sacroiliac separations in 23.5% (n=61) [bilateral sacroiliac separation 10.4% (n=27), left sacroiliac separation 7.3% (n=19), right sacroiliac separation 5.7% (n=15)], ischial fractures in 19.6% (n=51), ilial fractures in 12.7% (n=33), symphysis pelvis separation in 10.4% (n=27), acetabular

fractures in 7.7% (n=20), and sacral fractures in 1.5% (n=4) of cases. The results were given in detail in Table 1.

Table 1. Demographics, aetiology, and localization of fractures in cats included in the study (n=144).

Demographics	**n**	**%**
Male	83	57.6
Female	61	42.4
0-1 age	85	59.02
1-2 age	48	33.33
>2 age	11	7.63
Mixed Breed	126	87.5
British Shorthair	8	5.5
Scottish Fold	7	4.86
Van Cat	1	0.69
Ankara Cat	1	0.69
Iran Cat	1	0.69
Etiology of fractures		
Traffic Accidents	95	65.97
Fall from high	42	29.16
Unknown	7	4.86
Lokalization of fractures		
Acetabular fractures	20	7.72
Right sacroiliac fractures	15	5.79
Left sacroiliac	19	7.33
Bilateral sacroiliac fractures	27	10.42
Ilium fractures	33	12.74
Symphisis pelvis separations	27	10.42
Ischium fractures	51	19.69
Pubis Fractures	63	24.32
Sacrum fractures	4	1.54
Total	**259**	**100**

Out of a total of 144 cats diagnosed with pelvic fractures, 86.1% (n=124) underwent surgical treatment, while 13.9% (n=20) received conservative treatment with cage rest only. The surgical methods applied according to fracture classification were detailed in Table 2. Radiographic images of the some of the applied methods were shown in Figure 1 and 2. Of the patients, 73.61% (n=10) were discharged after treatment, while 26.38% (n=38) died due to various reasons.

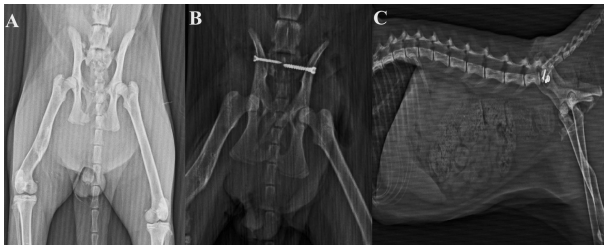

Figure 1. Radiographic image of the treatment of bilateral sacroiliac separation with iliosacral screwing method (A: Pre-op VD, B: Post-op VD, C: Post-op LL).

Figure 2. Radiographic image of the treatment of a corpus ilium fracture case with locking plate osteosynthesis method (A: Pre-op VD, B: Post-op VD, C: Post-op LL).

Table 2. Treatment options applied according to the type of fracture.

Fractures	**n**	**Operative treatment Options**	**Operative treatment n (%)**	**Cage rest (conservative treatment) n (%)**
Right sacroiliac separations	15	Iliosacral screw	50 (81.96)	11 (18.03)
Left sacroiliac separations	19			
Bi lateral sacroiliac separations	27			
Acetabular fractures	20	Acetabular C plate	11 (55)	4 (20)
		Excision arthroplasty	5 (25)	
Ilium fractures	33	Locking plate + Cerclage wire	27 (81.81)	6 (18.18)
Symphysis pelvis separation	27	Cerclage wire	10 (37.03)	17 (62.96)
Ischial fractures	51	Cerclage wire	20 (39.21)	31 (60.78)
Pubic fractures	63	-	-	63 (100)
Sacral fractures	4	Dorsal laminectomy	1 (25)	3 (75)
Total	259			

DISCUSSION

This study examines the pelvic fractures of cats that presented to the Siirt University Veterinary Health Application and Research Hospital over a five-year period, providing significant material statistically analyzing pelvic fractures in cats. Unlike previous studies (Yurtal et al., 2022; Çatalkaya et al., 2024) in this field, this study contains a large data set that focuses exclusively on cats.

Previous studies have reported that pelvic fractures are mostly encountered in young animals (1-3 years) (Bennet, 1975; Bookbinder and Flanders, 1992; Sadan et al., 2016; Altunatmaz et al. 2004; Bourbos et al., 2020; Yurtal et al., 2022; Çatalkaya et al., 2024). Similarly, in this study, it was determined that the average age of animals with pelvic fractures was 13.1 months. It is thought that the reason for this could be that young animals are more active and have difficulties living on the street due to a lack of life experience.

When evaluating the gender distribution of animals diagnosed with pelvic fractures, previous studies have indicated a higher incidence in male cats compared to female cats (Bennet, 1975). Contrarily, Ünsaldı (1995) reported a higher prevalence of pelvic fractures in female cats. The present study corroborates Bennet's findings, revealing a greater occurrence of pelvic fractures in male cats. These divergent findings highlight the necessity for more comprehensive research to understand the factors influencing the incidence of pelvic fractures across different genders.

Yurtal et al. (2022) reported no statistically significant relationship between pelvic fractures and cat breeds in their study. In contrast, Solak (2021) found that mixed-breed cats were more affected by pelvic fractures. In the present study, the majority of the cats were of mixed breed. This suggests that the prevalence of pelvic fractures in these animals is likely due to the high population of mixed-breed stray cats in Siirt region rather than a specific breed predisposition. Consequently, these cats are more susceptible to traffic accidents, resulting in pelvic fractures.

Studies have indicated that the etiology of pelvic fractures is associated with factors such as traffic accidents, falls from heights, blunt force trauma, dog attacks, and neoplastic lesions (Altunatmaz et al., 2004; Sağlam et al., 2016; Meeson and Geddes, 2017; Yurtal et al., 2022; Çatalkaya et al., 2024). Traffic accidents have been highlighted as the most common cause of pelvic fractures in numerous studies (Altunatmaz et al., 2004; Meeson and Geddes, 2017; Yurtal et al., 2022). Researchers have emphasized that this prevalence is due to the complex structure of large cities (Meeson and Geddes, 2017). Similarly, in this study, it was determined that cases resulting from motor vehicle accidents accounted for over 65% of all incidents, making it the most common cause. The second most common cause identified was falls from heights.

Studies have indicated that the proportion of pelvic fractures to total fractures ranges from 20-30% (Altunatmaz et al., 2004; Draffan et al., 2009; Sadan et al., 2016; Bourbos et al., 2020; Cinti et al., 2020). However, when the data obtained in this study were examined, it was seen that 144 (9.44%) of the 1524 fracture cases were pelvic fractures.

In general, the most frequently encountered type of fracture in pelvic fractures is reported to be pubic fractures, which constitute the pelvic floor (Bookbinder and Flanders, 1992; Sadan, 2016). In a study conducted by Aksoy and Özsoy (2003) on 239 ossa coxae fractures, they diagnosed 32.2% pubic fractures, 28.8% iliac fractures, 21.7% ischial fractures, and 17.1% acetabular fractures. Similarly, Yurtal et al. (2022) identified 88 iliac fractures, 90 ischial fractures, 60 pubic fractures, 54 acetabular fractures, 139 sacroiliac separations, and 43 symphysis pubis separations in 183 cases of pelvic fractures. The data from our study indicate that pubic bone fractures, with a frequency of 24.32%, are the most common type of pelvic fracture, followed by sacroiliac separation at 23.5%, ischial fractures at 19.6%, iliac fractures at 12.7%, symphysis pubis separations at 10.4%, acetabular fractures at 7.7%, and sacral fractures at 1.5%. These results are consistent with the general literature.

In the studies by Bookbinder and Flanders (1992) and Piermattei and Johnson (2004), it was emphasized that due to the box-like nature of the pelvic structure, a fracture in one bone could lead to a fracture in another bone. In the present study, the fact that at least two pelvic fractures were detected in 88 out of 144 animals (61.1%) supports this theory.

Literature reviews have indicated that sacral fractures, iliac fractures, and acetabular fractures, as well as fractures that cause more than 50% narrowing of the pelvic canal-essentially the bones

that bear more body weight-require surgical treatment (Meeson and Geddes, 2017; Arıcan, 2019a; Arıcan, 2019b; Çatalkaya et al., 2024). Conversely, fractures for which conservative treatment is more often chosen include pubic, ischial, and posterior one-third acetabular fractures (Arıcan, 2019a; Arıcan, 2019b; Çatalkaya et al., 2024).

When evaluating the treatment methods applied to cases in this study, it was observed that 50 sacroiliac separations, 16 acetabular fractures, 27 iliac fractures, 10 symphysis pelvis separations, and 1 sacral fracture were treated surgically (86.1% of 144 cats), while 11 sacroiliac separations, 4 acetabular fractures, 6 iliac fractures, 17 symphysis pelvis separations, 31 ischial fractures, 63 pubic fractures, and 3 sacral fractures were treated conservatively (13.9% of 144 cats).

Thus, it is accurate to state that the treatment options throughout the study were determined in accordance with the literature. Furthermore, we believe that adhering to the principle of first stabilizing the patient's vital functions, as supported by the literature (Kim et al., 2011; Meeson and Cor, 2011; Sadan et al., 2016; Gant and Asztalos, 2019; Parlak et al., 2021; Çatalkaya et al., 2024), played a significant role in the recovery processes of the patients.

CONCLUSION

This study provided significant findings on the etiology and treatment options of pelvic fractures in cats. The analyses revealed that pelvic fractures predominantly occur as a result of traumatic events such as motor vehicle accidents and falls from heights.

The study determined that operative intervention plays a crucial role in the treatment of pelvic fractures. More favorable outcomes and higher discharge (recovery) rates were observed in cats that underwent surgical treatment. However, it was also considered that in some cases, surgery may not be appropriate, and medical management should be employed.

In conclusion, this study highlights the potential significance of surgical intervention in the management of pelvic fractures in cats and underscores the necessity of carefully evaluating the appropriateness of such interventions. Furthermore, adopting a standardized approach to the treatment of pelvic fractures could contribute to better outcomes in clinical practice. Future research will provide valuable insights into the development of treatment strategies for pelvic fractures in cats.

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