

## THE CLINICAL STUDIES ON THE TREATMENT OF PELVIC FRACTURES OF CATS AND SMALL BREED DOGS WITH MINI TITANIUM PLATES AND SCREWS

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*Kedi ve küçük yapılı köpek ırklarında pelvis kırıklarının mini titanyum plak ve vidalarla sağaltımı üzerine klinik çalışmalar*

**Özet:** Pelvis bölgesi güçlü kaslar ve yumuşak doku tabakası ile sarılmıştır. Bu bölge kemiklerindeki kırıklara genellikle direkt travmalar neden olur. Pelvis kırıklarının sağaltımında şirurjikal prosedürün amacı, pelvis kanalını daraltan fragmanların redüksiyonunu sağlamak ve sacroiliac eklem, ilium ve acetabulum gibi yüklenme bölgelerini stabilize etmektir.

Bu klinik çalışmada, kedi ve küçük ırk köpeklerin pelvis kırıklarının sağaltımında fikzasyon materyali olarak mini titanyum plak ve vidalar kullanıldı. Çalışma materyalini, Ankara Üniversitesi Veteriner Fakültesi Ortopedi ve Travmatoloji Bilim Dalı Kliniğine 1996-1999 tarihlerinde muayene için getirilen değişik ırk, yaş ve cinsiyetteki 6 kedi ve 3 küçük yapılı ırk köpek oluşturdu. Operatif sağaltım klinik ve radyolojik muayenelere göre değerlendirildi. Radyografik muayene sonuçlarına göre olguların 5'inde ilium, 2'sinde ischii, 1'inde acetabulum ve 1'inde de multiple pelvis kırığı tespit edildi. Gruptaki pelvis kırığı bulunan 3 olguda aynı zamanda sacroiliac lükzasyon vardı. Dört veya beş delikli, 0.8mm kalınlıkta mini titanyum plaklar, kırığın tipine ve lokalizasyonuna göre barlı ve barsız olarak seçildi. Vidaların uzunlukları ise 7-11mm arasında belirlendi. Tüm olguların klinik ve radyolojik muayeneleri düzenli olarak yapıldı ve postoperatif komplikasyon görülmedi. Bulguların doğrultusunda mini titanyum plakların ve vidaların küçük olmaları, kolayca şekillendirilmeleri ve operasyon sırasında rahat kullanımları nedeniyle kedi ve küçük ırk köpeklerin pelvis kırıklarının sağaltımında tercih edilebilir bir fikzasyon materyali olduğu kanısına varılmıştır.

**Anahtar kelimeler:** Kedi, küçük yapılı köpek, mini titanyum plak, pelvis kırıkları.

**Summary:** As the pelvic region is well covered with muscles and soft tissues, the fractures of the bones of this structure, are generally caused by direct traumas. The aim of performing a surgical procedure to treat a pelvic fracture is to reduce the fragments which narrows the pelvic canal and to stabilize the weight bearing segments like sacroiliac joint, ilium and acetabulum.

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*In this clinical study, mini titanium plates and screws were used as fixation materials for the treatment of pelvic fractures of cats and small breed dogs. The study group was performed by 6 cats and 3 small breed dogs in different breeds, ages and sexes which were examined in the clinics of the Department of Traumatology and Orthopedics, Faculty of Veterinary Medicine, Ankara University, between the years of 1996-1999 and surgical treatments were considered according to the clinical and radiological examinations. In the radiographic evaluations of these cases revealed that 5 of the animals had ilium fracture, 2 animals had ischii fractures, 1 animal had acetabular fracture and one animal had multiple pelvic fractures. Three of these animals had ilium fractures accompanied by sacroiliac luxation. The mini titanium plates which have 0.8 mm in thickness and 4 or 5 holes were selected with or without bars according to the type and the localization of the fractures. The screws ranged between 7 and 11 mm in length. The clinical and radiological examinations of all cases were periodically performed and no postoperative complications were observed. From the findings, it was concluded that mini titanium plates and screws are recommended as fixation materials for the surgical treatments of pelvic fractures in cats and small breed dogs because these materials are small in size, easy to shape and use in the operations.*

**Key words:** *Cat, small breed dog, mini titanium plates, pelvic fractures.*

### Introduction

Pelvic girdle is formed by articulation of os coxae, composed of os ilium, os pubis and os ischii with each other in the ventral and sacrum in cranio-dorsal (9). Fractures at this osteoid matrix which is surrounded by strong and thick muscle stratum are caused by direct traumas such as getting hit by motorized vehicles, falling down from high places, being shot and wounded by fire-arms (3,4,5,6,15). Pathological fractures which are caused by bone tumors and results of methobolical diseases are rare in incidence (5). These fractures also have multiple characteristics due to the rectangular configuration of bones involved (1,3,6,15).

Pelvis provides support for rare extremities, attachments for many of the muscle groups and a large canal for important nerves, blood vessels and the other soft tissue (urogenital and gastrointestinal). It is reported that pelvic fractures compromise the functions of those structures mentioned above, thus risking any involved (3,5,6,15). Apart from the traumas of the organs in that part, other lesions such as pulmonary contusions, rib fractures, pneu-

mothorax, nerve lesions, spinal or extremite fractures could be observed (3,4,5,15).

External and internal (rectal) examinations make it possible to locate fractures of pelvis and functional defaults of rare limbs, and possible further complications. Upon external palpation when wings of ilium, the greater trochanter, the ischial tuberosity, and the dorsal spinal proceses of sacrum are taken as referance points, deplacement and instability of pelvis can be determined as well as crepitation and symptomatic pains (15).

Internal examination allows an evaluation of palpation of fractures, the rate of constriction of pelvic canal, the location of fractured fragments, the functions of anal sphincter and perforation of rectum. The examination of anal sphincter is important in order to specify lesions which could be formed at pudental nerve in pelvic fractures especially when sacrum is involved (1,15). In neurological examinations of the extremity involved, anus and perineal regions should be performed before the treatment protocol is applied in pelvic fractures (1,3,4,6,15).

Taking two way plane roentgenograms helps verify the pelvic fractures and other lesions radiologically as the last stage of examinations (1,3,4,15).

The treatments of pelvic fractures are sub-categorized as surgical and nonsurgical interventions (3,6,15). Nonsurgical management method relies on the principle that the muscle groups of pelvis and soft tissues such as sacrotuberous ligaments will have internal splint and support role in the pelvic fractures (15). In order to proceed with this treatment protocol, there must be very little or no displacement among the fragments. Having the patients rest in a limited space, minimizing their activities and regular observation of urination and defecation constitute and important part of this treatment protocol (3,5,7,15).

Surgical treatment is considered under the following situations.

1. Fractures and luxations involving sacroiliac articulations (4,10).
2. Bilateral corpus ilium fracture and its evident displacement (5,15).
3. Acetabular fractures accompanied by displacement which are observed on the surface of the joints(5,7,15).
4. Coxa-femoral luxations or fractures of extremities involved due to single or double sided sacroiliac stabilization loss (1,3,6,7,15).
5. A significant stabilization loss in hips (e.g. single or double sided ilium, ischii and pubis fracture) (1,5,6,7).
6. Fractures causing significant constriction of diameter of pelvic canal (1,5,6,7,11).
7. Fractures or luxations which will cause posture, walking and stepping defects (5,7).

The general aim of surgical intervention is removing the fragments which apply pressure on pelvic canal and stabilizing pelvis segments on which physical force is transferred during stepping (14). Weight-bearing areas of the pelvis are sacroiliac joint, ilium and acetabulum. Fractures of this area requires surgical intervention. However, pubis and ischii are not

weight-bearing areas and generally do not require a surgical fixation (4,6,7,10,15). In multiple fractures, the literature reveals that with the reduction of stepping areas, the spontaneous reduction of ischii and pubis fractures are possible (7).

In pelvic fractures, a preoperative waiting period for the patient to stand up make it possible for a detailed evaluation of the case (3,5,7,15). But spastic contractions of muscle due to long waiting period may lead to difficulties in surgical reductions in young animals and large breeds of dogs with significant displacement fractures. Therefore, pelvic fractures must be surgically intervened within 3-5 days following the trauma (1,3,7,10,15).

Different fixation techniques are defined for different pelvic fractures. These are screws, plates and pins implementations for sacroiliac fractures (5,6,8,12,14); plates for ilium fractures (4,6,7,8,15); pin, cerclage implementations for some ilium fractures (4,15,16); plates for acetabulum fractures (2,6,8,13,15).

This study aimed at contributing to the clinical studies related to the implementation of mini titanium plates and screws in pelvic fractures of cats and small breed dogs.

### Materials and Methods

Six cats and three small breed dogs of different ages, breeds and sexes which were brought to the clinics of Department of Orthopedics and Traumatology, Faculty of Veterinary Medicine, Ankara University, between the years of 1996-1999, constituted the study group of this study.

Two way plane radiographycal evaluations of these cases revealed that 5 of them had ilium fracture (cases no: 1,3,5,6,8), two cases had ischii fractures (cases no: 4,9) one case had acetabular fracture(case no: 2) and one case had multiple pelvic fractures (case no: 7). Three cases had ilium fractures accompanied by sacroiliac luxation (case: 3,5,8).

The mini titanium plates were selected with or without bars considering the type and

localization of the fractures. The plates were 0.8 mm in thickness and had 4 or 5 holes. In implementation of the plates, titanium screws of 2 mm in diameter and 7-11 mm in length were used.

Animals were operated under the general anesthetic element of ketamin hydrochloride (Ketalar 50mg/ml, Parke-Davis) administered following xylazin hydrochlorid (Rompun 23.32 mg/ml, Bayer) premedication. A large area was shaved and disinfected and the case was stabilized on the operation table in lateral position.

After exposition of the fracture, reduction was achieved through the traction, elevation and rotation of the fragments, through the radiographical findings, each fragment was implemented and stabilized with pre-bended, 4 or 5 holed mini titanium plates with the use of at least 2 screws, after positioning.

The muscles which were transversally incised at the operation stage were sutured with 3/0 or 4/0 chrome catgut and the skin sutured with non-absorbable suture material. A protective dressing and Robert-Jones bandage were applied on the area and extremite involved. The patients received parenteral lincocin+ spectinomysine (Linco-spectine, 50mg/ml, Eczacıbaşı) for six days post-operatively

The cases were evaluated with 10 days intervals by clinical and radiological examinations.

### Findings

The history of the patients and clinical examinations revealed that 5 animals received the trauma through falling from high places (cases no: 2,3,4,5,8) and 3 animals from traffic accidents (cases no: 1,6,7) and one animal from direct trauma (case no: 9). None of animals had defecated for 3 days following the trauma. Two animals had hematuria (cases no: 2,6), 1 animal had bloody vomit content (case no: 7), one animal (case no: 8) had a cleft palate of 3 cm in length. Another animal had (case no: 2) left radius-ulna in shaft fracture. All the animals re-

sponded positively to treatment attempts, and urination and defecation were regular shortly after the operation.

Robert-Jones bandage was applied on the extremite involved and the patients were asked to be brought in on the 10<sup>th</sup> day for the removal of the sutures and bandage for clinical and radiological examinations. No operational complications were detected during those examinations. After the removal of the sutures and bandage, all the patients were radiologically examined under the anesthetics and no post-operative complications were observed.

Mini-titanium plates and screws used as osteosynthesis material remained intact and no relevant complications were observed.

Finding of the cases are presented in table 1 and radiographic result are shown in figures 1,2,3,4,5,6,7,8.

### Discussion and Conclusion

Literature review reveals that serious traumas such as traffic accidents and falls from high places have important roles in inflicting fractures in the pelvis region although it is well covered with strong and thick muscles. A detailed general examination of the soft tissues and other areas is highly recommended in order to reveal possible lesions as well as pelvic fractures, considering the extent of the traumas (3,4,5,6,15). In this study the traumas of the pelvic region is reported to be caused by falling from high places in 5 cases, traffic accidents in 3 cases and direct trauma in 1 case. Upon general examination hematuria, temporary defecation difficulties or absence of defecation, emesis, cleft palate and fracture of the radius-ulna were observed. There were positive responses to the treatment attempts

It is suggested that the extremity involved, anus and perineal region be neurologically examined before the application of a specific treatment protocol (1,3,4,6,15). All the cases in this series were examined for nerve lesions and no lesion was detected.

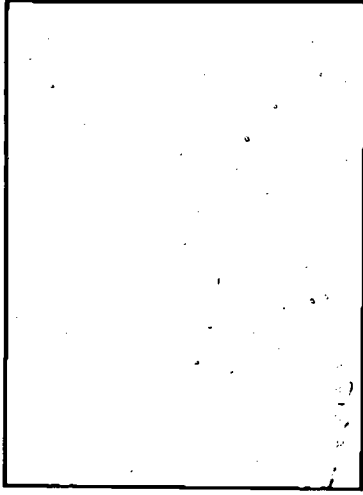


Figure 1. Preoperative radiographical view of case 2.  
Şekil 1. Olgu no:2'nin operasyon öncesi radyografik görünümü.

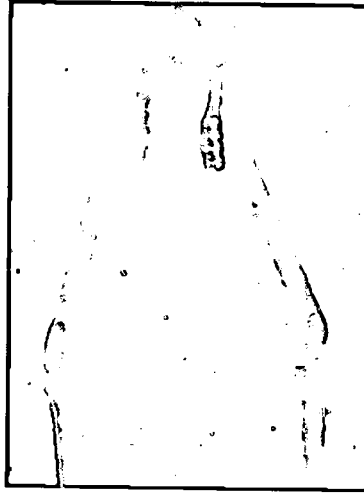


Figure 2. Postoperative radiographical view of case:2 in 3<sup>rd</sup> week.  
Şekil 2. Olgu no:2'nin operasyon sonrası 3. haftadaki radyografik görünümü.

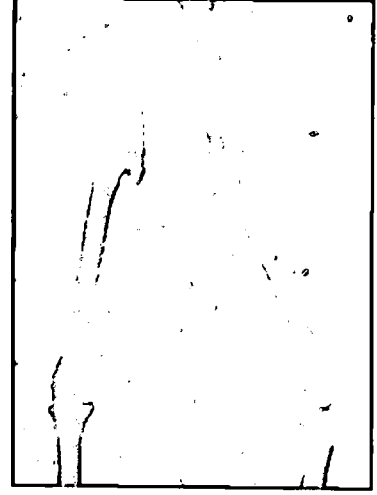


Figure 3. Preoperative radiographical view of case:3.  
Şekil 3. Olgu no:3'ün operasyon öncesi radyografik görünümü.

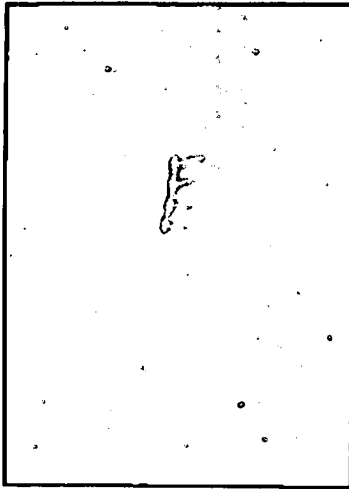


Figure 4. Postoperative radiographical view of case:3 in 3<sup>rd</sup> week.  
Şekil 4. Olgu no:3'ün operasyon sonrası 3. haftadaki radyografik görünümü.

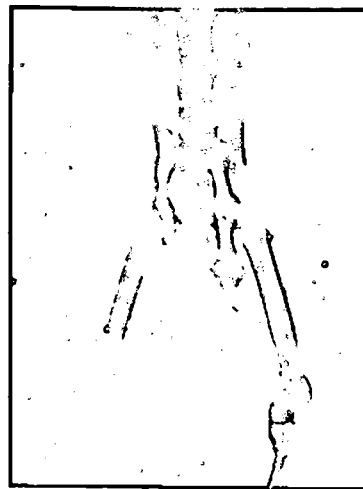


Figure 5. Preoperative radiographical view of case:5.  
Şekil 5. Olgu no:5' in operasyon öncesi radyografik görünümü.

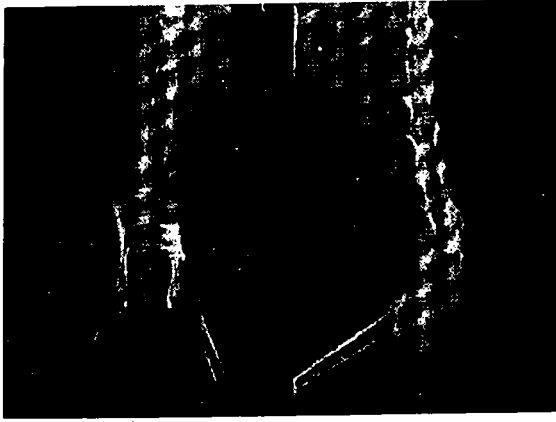


Figure 6. Postoperative radiographical view of case:5 in 7<sup>th</sup> week.  
Şekil 6. Olgü no:5' in operasyon sonrası 7. haftadaki radyografik görünümü.



Figure 7. Preoperative radiographical view of case:6  
Şekil 7. Olgü no:6' in operasyon öncesi radyografik görünümü.

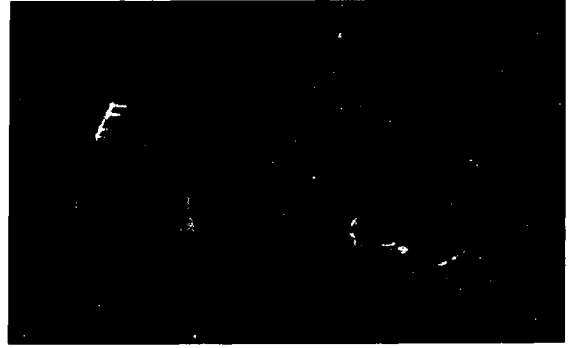


Figure 8. Postoperative radiographical view of case:6 in 3rd week.  
Şekil 8. Olgü no:6' in operasyon sonrası 3. haftadaki radyografik görünümü.

Table 1. Findings and results about the cases.  
Tablo 1. Olgulara ait bulgular ve sonuçlar

case no	Cases of				Localization of fracture	Etiology	Results
	Species	Breed	Age	Sex			
1	Dog	Terrier	4	F	Right corpus ilium	Traffic accident	Clinically good result after 2 weeks
2	Cat	Siamese	3	F	Left acetabular	Falling from high place	Clinically good result after 2 weeks
3	Cat	Turkish Angora	2	M	Right ilium	Falling from high place	Clinically good result after 2 weeks
4	Cat	Turkish Angora	3	M	Left caudal acetabulum and ischii	Falling from high place	Clinically good result after 3 weeks
5	Cat	Mix Breed	1	F	Left ilium	Falling from high place	Clinically good result after 2 weeks
6	Dog	Terrier	1	F	Right ilium	Traffic accident	Clinically good result after 2 weeks
7	Dog	Terrier	3	M	Multible pelvis	Traffic accident	Clinically good result after 4 weeks
8	Cat	Mix Breed	11 month	M	Right ilium	Falling from high place	Clinically good result after 2 weeks
9	Cat	Siamese	3	M	Right ischii	Direct trauma	Clinically good result after 2 weeks

In the literatures (4,6,7,10,14), surgical intervention in pelvic fractures is defined as a means to reduce the fragments applying pressure on the pelvic canal and the fractures of sacroiliac joint, ilium and acetabulum upon which the physical force is transferred during the weight bearing. Surgical intervention is also reported to enable the fixation of the fractures of these parts. All the fractures of the cases are observed to be in the sacroiliac joint, ilium and acetabulum which are weight bearing segments of rare limbs. In two cases ischii fractures is formed in caudal acetabular region.

The literature findings report that surgical reduction may be difficult to achieve in young animals and large breeds of dogs having significant displacement fractures due to the spastic muscle contractions caused by long periods of waiting, especially because of the strong muscle structure of this part. Therefore, pelvic fractures need to be surgically treated in 3-5 days following the trauma (1,3,7,10,15). In this study, the cases were operated after 2-3 days of the pre-treatment. One of the animals (case no:6) had missed the operation date and had a lameness problem and was asked to be brought in on the 7 th day for the operation. The reduction was achieved following the operation. And the reduction was achieved at the desired level all cases.

Different fixation techniques are used for the pelvic bone fractures in different sections. These are plates, screws and pins for sacroiliac luxations (5,6,8,12,14), plates for ilium fractures (4,6,7,8,15), pins and cerclage some ilium fractures (4,15,16) and plate implementations for acetabular fractures (2,6,8,13,15).

This study aimed at implementing mini titanium plates and screws in pelvic fractures to report the results.

According to the results mini titanium plates and screws are recommended as fixation materials for the surgical treatment of pelvic fractures in cats and small breed dogs because these materials are small in size, easy to shape and use in the operations.

## References

1. **Betts, C.W.** (1993) *Pelvic Fractures*. 1769-1785. In: Slatter, D.(Ed.): *Textbook of Small Animal Surgery*. WB Saunders Company, Philadelphia.
2. **Braden, T.D., Prieur, W.D.** (1986) *New Plate for Acetabular Fractures: Technique of application and Long Term Follow-up evaluation*. JAVMA. **188** (10) 1183-1186.
3. **Brinker, W.O., Piermattei, D.L., Flo, G.L.** (1983) *Handbook of Small Animal Orthopedics and Fracture Treatment*. 395-421.WB Saunders Company, Philadelphia.
4. **Brinker, W.O., Piermattei, D.L., Prieur, W.D.** (1984) *Manuel of Internal Fixation in Small Animals*. Springer-Verlag, Berlin. 152-165.
5. **De Angelis, M.** (1981) *Fractures of the Appendicular and Heterotropic Skeleton*. 782-790. In: Bojrab, M.J. (Ed.): *Pathophysiology in Small Animal Surgery*. Lea & Febiger, Philadelphia.
6. **De Camp, C.E.** (1992) *Principles of Pelvic Fracture Management*. *Seminars in Veterinary Medicine and Surgery (Small Animal)*, 7 (1) 63-70.
7. **Denny, H.R.** (1993) *A Guide to Canine and Feline Orthopedic Surgery*. Third Ed. Blackwell Scientific Publications, Oxford. 291-301.
8. **Denny, H.R.** (1991) *Fracture Fixation in Small Animal Practice*. In *Practice*, July 137-143.
9. **Gültekin, M.** (1966) *Evcil Memeli ve Kanatlıların Karşılaştırmalı Osteologia'sı (Pasif Hareket Sistemi)* AÜ Basımevi, Ankara. 132-133.
10. **Harvey, C.E., Newton, C.D., Schwartz, A.** (1990) *Small Animal Surgery*. JB Lippincott Company, Philadelphia. 594-595.
11. **Leighton, R.L., Jones, K.** (1983) *A Compendium of Small Animal Surgery*. Ventura Press, California. 274.
12. **Montovon, P.M., Boudrieau, R.J., Hohn, R.B.** (1985) *Ventrolateral Approach for Repair of Sacroiliac Fracture-Dislocation in the Dog and Cat*. JAVMA. **186** (11) 1198-1201.
13. **Olmstead, M.L.** (1990) *Surgical Repair of Acetabular Fractures*. 656-661. In: Bojrab, M.J.(Ed.): *Current Techniques in Small Animal Surgery*. Third Ed. Lea&Febiger, Philadelphia.
14. **Radasch, R.M., Merkley, D.F., Hoefle, W.D., Peterson, J.** (1990) *Static Strength Evaluation of Sacroiliac Fracture-Separation Repairs*. *Veterinary Surgery*. **9** (2)155-161.
15. **Tarvin, G.B., Lenehan, T.M.** (1990) *Management of Sacroiliac Dislocation and Iliac Fractures*. In: Bojrab, M.J. (Ed.): *Current Techniques in Small Animal Surgery*. Third Ed. Lea&Febiger, Philadelphia. 649-656.
16. **Ünsaldı, E.** (1995) *Kedilerde Pelvis Kırıklarının Osteosentez ile Sağaltımı*. AÜ Veteriner Fakültesi Dergisi. **42** (2) 129-138.

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