



PELVIC FLOOR FRACTURES IN 55 DOGS AND 39 CATS: CT AND X- R FINDINGS

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ABSTRACT

Radiographic examination of the pelvis is the standard diagnostic test for evaluating dogs with suspected pelvic trauma, but because of the complexity of many pelvic floor fractures and the superimposition of bony structures, a precise description of the injury can be difficult to obtain from standard radiographs. Computed tomography (CT) imaging is an important component in the pre-operative assessment and management of pelvic fractures in humans and small animal. The objective of this study was to investigate the benefits of radiographic and CT images in the diagnosis of pelvic floor fractures in dogs and cats. Our hypothesis was that CT would detect the different types of pelvic floor fracture than radiographic examination of these fractures. Radiographic examination and CT scan of 94 traumatized cases of canine and feline pelvic floor fractures were evaluated, where CT images and radiographic assessments were performed on each case. Radiographs and CT images were reviewed on separate occasions and fracture assessments were evaluated. Of the examined 55 dogs and 39 cats, unilateral ischium fractures were the most common detectable fractures in dogs (67.92%) and in cats (72.41%) (Table 1). Different fracture lines (transverse, longitudinal and oblique fractures lines) of ischium and pubic bones were observed, they were more clear in the computed tomography than in plain radiographs. Pelvic floor fractures were associated with unilateral sacroiliac joint luxation, bilateral sacroiliac joint luxation and femur luxation and fractures of sacrum, ilium, acetabulum, femur and tibia (Table 2).

Keywords: Pelvic, Floor, Fracture, Dogs, Cats, X- ray, CT.

Contribution/ Originality

This study contributes by way of showing the benefits of radiographic and CT images in the diagnosis of pelvic floor fractures in dogs and cats. This study documents that CT would detect the different types of canine and feline pelvic floor fracture than radiographic examination of these fractures.

1. INTRODUCTION

Pelvis fracture is a common injury in dogs and cats, accounting for 20 to 30% of all trauma-induced fractures [1, 2]. The majority occur in healthy animals under three years of age [3]. The box like configuration of the pelvis ensures that any trauma sufficient to produce a fracture will always cause additional pelvic trauma [4]. In cats, the most common pelvic fracture involves the pelvic floor, occurring in 90% of cases in one study [5]. Pelvic floor fractures may be classified as symphyseal separations, or as unilateral or bilateral fractures of the pubic body and ramus or ischial body [6]. In addition, concurrent unilateral or bilateral sacroiliac luxations or unilateral ilial fractures occurred in more than 50% of cats [5].

Severe trauma, such as motor vehicular accidents, is usually the cause of pelvic fractures. Concurrent injuries to other body systems, including life-threatening injuries, are also common and must be identified and treated in a timely fashion. Several specific types of injury occur in the pelvis, including sacroiliac luxation, fractures of the non articular portions of the pelvis, and articular fractures [2].

Multiple fractures of the canine pelvis and surrounding soft-tissue and organ injury frequently result [7]. Soft-tissue injuries commonly associated with pelvic fractures involve the lower urinary [8, 9] and gastrointestinal tracts [10] and peripheral nerves [9, 11].

The pubis is L-shaped and consists of the body (corpus ossis pubis), the transverse acetabular branch (ramus cranialis ossis pubis) and the sagittal symphyseal branch (ramus caudalis ossis pubis). The pubis borders more than half of the obturator foramen, a large opening in the pelvic /floor through which the obturator nerve passes. The ischium can be divided into the body (corpus ossis ischii), the caudal plate (tabula ossis ischii) and the medial branch (ramus ossis ischii).The caudal plate extends cranially into two branches, a symphyseal branch and an acetabular branch [12].

Radiographic examination of the pelvis is the standard diagnostic test for evaluating dogs with suspected pelvic trauma. Lateral and ventrodorsal projections constitute a typical examination [13] but because of the complexity of many pelvic fractures and the superimposition of bony structures, a precise description of the injury can be difficult to obtain from standard radiographs.

Computed tomography (CT) imaging is an important component in the pre-operative assessment management of pelvic fractures in humans and small animals [14]. Computed tomography (CT) has revolutionized veterinary medicine and is considered to be one of the most

valuable tools for the imaging work-up of neurological, oncological and orthopedics canine and feline patients. In small animals with acute trauma, particularly those involving complex anatomic areas such as the head, spine or pelvis, CT has been established as a standard imaging method. With the increasing availability of radiation therapy in veterinary medicine, CT has also become the principal tool to stage a tumor, assess response, and guide radiation therapy [15].

It is the purpose of this study to compare the diagnostic accuracy of two-view radiography and CT scanning in the evaluation of pelvic floor trauma in dogs and cats. This should aid in defining the potential role of standard radiographic views and CT scanning in dogs and cats with pelvic floor trauma.

2. MATERIALS AND METHODS

All dogs and cats presenting to the Clinic for Small Animals Surgery, Justus Liebig University, Giessen, Germany with a history of pelvic trauma between January 2008 – July 2013 were evaluated radiographically and computed tomographically. Radiographic examinations of the affected dogs and cats were carried out with the animal in recumbent position under effect of general anaesthesia by using of X- ray apparatus (Hoffman Co., Germany) with maximum output of 125 kV and 500 mAs with the standard two-view (lateral and ventrodorsal) [13] (Fig. 1 A, B). A lateral oblique view isolating one hip joint was made when pelvic floor fracture was suspected from the standard two views examination. Computed tomography examinations were performed on all dogs and cats in which pelvic floor fractures were identified radiographically. CT examinations were carried out with the animal in dorsal recumbency with the pelvic limbs flexed under effect of general anaesthesia by using of CT apparatus (Brilliance TM CT 16, Philips medical system Co., Germany) and CT images (Coronal, axial and sagittal views) (Fig. 1 C, D). were obtained in each patient [16].

The radiographic and CT examinations of the pelvic floor fracture were reviewed. The review of each radiographic view and each CT examination included the sacrum, sacroiliac (SI) joints, ilium and acetabulum. The criteria of this review include, the injury of the pubis, and ischium, type of fracture and number of bone fragments resulted from pelvic floor fractures. Clinical examination of all traumatized dogs was performed to detect the degree of lameness occurred due to trauma and fracture of the pelvic bone.

3. RESULTS

Pelvic floor fractures were reported in 55 dogs and 39 cats presented to the Clinic for Small Animals, Surgery, Justus Liebig University, Giessen, Germany. The body weight ranged from 2.1 kg to 45 kg in dogs and from 1.9 kg to 5.5 kg in cats, with a mean weight of 16.6 kg in dogs and 3.8 kg in cats. The mean age of dogs at the time of fracture was 6.5 yr (2 to 17 yr) and 6.4 yr in cats (3 months to 17 yr). Twenty four dogs and 25 cats were male and 31 dogs and 14 cats were

female. All of the animals were clinically examined during the study. Clinical examination of these dogs and cats revealed different degrees of lameness varied from 1st degree to 4th degree.

On radiographic and CT evaluation of the pelvic floor fractures in the examined 55 dogs and 39 cats, unilateral ischium fractures were the most common detectable fractures in dogs (67.92%) and in cats (72.41%) (Table 1). Different fracture lines (transverse, longitudinal and oblique fractures lines) of ischium and pubic bones were observed with presence of small multiple compressed bone fragments, when compared to CT examinations, the fracture line and the number of these bone fragments (three to four bone fragments) was seen more obviously on the computed tomography evaluation than radiographic evaluation (Fig. 1 A, B, C, D).

Radiographic and CT evaluation of the pelvic floor fractures in 55 dogs and 39 cats revealed 36 unilateral ischium fracture (67.92 %) in dogs and 21 (64.3%) in cats, thirty one (59.61%) unilateral pubis fractures were in dogs and 18 (54.54%) in cats. Pelvic symphysis separation occurred more common in cats than in dogs (Table 1). All of the examined animals had sustained unilateral sacroiliac joint luxation, bilateral sacroiliac joint luxation and femur luxation and fractures of sacrum, ilium, acetabulum, femur and tibia, in addition to their pelvic floor fractures (Table 2) (Fig. 2 A, B).

Table-1. Number and percentage of pelvic floor fractures in 55 dogs and 39 cats

No	Fractures	Subdivision	Dogs		Cats			
			No	Total	No	%		
1	Ischium	Unilateral ischium	36	53	67.92	21	72.41	
		Bilateral ischium	15		28.30	6	20.68	
		Unilateral ischial table	1		1.88	1	3.44	
		Bilateral ischial table	1		1.88	--	--	
		Unilateral ischial tuberosity	--		--	1	3.44	
		Bilateral ischial tuberosity	--		--	--	--	
2	Pubis	Unilateral pubis	31	52	59.61	18	54.54	
		Bilateral pubis	21	40.38	15	33	45.45	
3	Pelvic symphysis separation	-	3	3	5.45	6	6	15.38

Table-2. Number of bones fractures and joints luxations accompanied with pelvic floor in 55 dogs and 39 cats:

Fractures and luxations	Dogs		Cats	
	No	%	No	%
Unilateral sacroiliac joint luxation	18	32.72	19	48.71
Bilateral sacroiliac joint luxation	4	7.27	5	12.82
Femur luxation	3	5.45	1	2.56
Sacrum	9	16.36	4	10.25
Ilium	16	29.09	12	30.76
Acetabulum	17	30.90	7	17.94
Femur fractures	-	-	3	7.69
Tibia	1	1.81	1	2.56

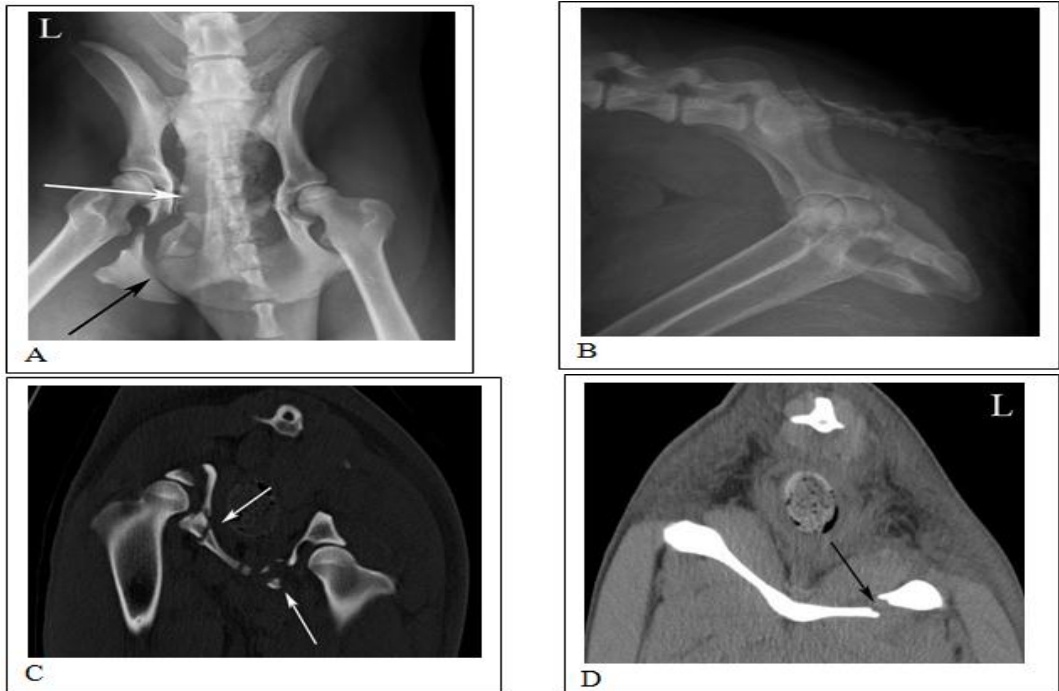


Fig-1. A) Ventrodorsal radiograph, B): Lateral radiograph, C): Computed Tomography dorsal view (bone window) and D): Computed Tomography dorsal view (soft tissue window) of both sides pubis fracture (white arrows) and of left an oblique ischium fracture (black arrow) in 2 years male Bernese Mountain dog. On radiographic analysis the bone fragments were not detected and the fracture and bone fragments were more clear on CT analysis.



Fig-2. A) Ventrodorsal radiograph of pelvic symphysis separation (black arrow) and bilateral sacro-iliac joint luxation in 6 years male Maine Coon cat. B): Ventrodorsal radiograph of bilateral sacro-iliac joint luxation (white arrow) in 3 years female European short hair cat.

4. DISCUSSION

Pelvis fracture is a common injury in dogs and cats, accounting for 20 to 30% of all trauma-induced fractures [1, 2]. Radiographic examination of the pelvis is the standard diagnostic test for evaluating dogs with suspected pelvic trauma. Lateral and ventrodorsal projections constitute a typical examination [13]. Computed tomography (CT) imaging is an important component in the pre-operative assessment management of pelvic fractures in small animal [14]. Pelvic floor

fracture assessment of 94 traumatized patients in the present study was more clear after CT scanning.

Pelvic floor fractures may be classified as symphyseal separations, or as unilateral or bilateral fractures of the pubic body and ramus or ischial body [6]. Regarding to the data of the present study, Radiographic and CT evaluation of the pelvic floor fractures in 55 dogs and 39 cats revealed 36 unilateral ischium fracture (67.92 %) in dogs and 21 (64.3%) in cats, thirty one (59.61%) unilateral pubis fractures were in dogs and 18 (54.54%) in cats. Pelvic symphysis separation occurred more common in cats than in dogs.

In studies comparing radiographic examination of pelvic fractures to CT scans, CT scanning was superior in allowing a more detailed description of known fractures and offering visualization of radiographically occult injuries. Also in our present investigation the CT scan was more accurate in description of fractures type, location and the number of bone fragments, which were not clear by radiographic examination.

Several specific types of injury occur in the pelvis, including sacroiliac luxation, fractures of the non articular portions of the pelvis, and articular fractures [2]. In the present study, pelvic floor fractures were associated with luxations and fractures of other parts of the pelvis such as unilateral sacroiliac joint luxation, bilateral sacroiliac joint luxation and femur luxation and fractures of sacrum, ilium, acetabulum, femur and tibia.

In addition to the pelvic floor fractures, concurrent unilateral or bilateral sacroiliac luxations occurred in more than 50% of cats [5]. This is in agreement with the results of the present study, where the unilateral or bilateral sacroiliac luxations were more common in cats than in dogs. CT scanning, however, can enhance the description of the comminution and displacement of fracture fragments or SI luxations, and sacrum, ilium and acetabular fractures with relation to the normal anatomy of the canine and feline pelvis.

5. CONCLUSION

Based on our data, Computed Tomography is more likely than plain radiographs to allow detection of different types of pelvic floor fractures in canine and feline pelvis.

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REFERENCES

- [1] J. Johnson, "Incidence of appendicular musculoskeletal disorders in 16 veterinary teaching hospitals from 1980 through 1989," *Vet. Comp. Orthopaed Traumatol.*, vol. 7, pp. 56-69, 1994.
- [2] M. C. Roach, *Saunders manual of small animal practice*, 3rd ed. Philadelphia: Saunders, 2006.
- [3] I. R. Phillips, "A survey of bone fractures in the dog and cat," *J. Small Anim. Pract.*, vol. 20, pp. 661-674, 1979.
- [4] D. L. Piermattei and K. A. Johnson, *Approach to the pelvis and pelvic symphysis, in: An atlas of surgical approaches to the bones and joints of dog and cat*, 4th ed. Philadelphia: Elsevier Saunders, 2004.
- [5] P. F. Bookbinder and J. A. Flanders, "Characteristics of pelvic fractures in the cat," *Vet. Comp. Orthop. Traumatol.*, vol. 5, pp. 122-127, 1992.
- [6] M. Messmer and P. M. Montavon, "Pelvic fractures in the dog and cat: A classification system and review of 556 cases," *Vet. Comp. Orthop. Traumatol.*, vol. 17, pp. 167-183, 2004.
- [7] J. Innes and S. Butterworth, "Decision making in the treatment of pelvic fractures in small animals," *In Practice*, vol. 18, pp. 215-221, 1996.
- [8] H. W. Boothe, "Managing traumatic urethral injuries," *Clin. Tech. Small Anim. Pract.*, vol. 15, pp. 35-39, 2000.
- [9] F. Verstraete and N. Lambrechts, "Diagnosis of soft tissue injuries associated with pelvic fractures," *Compend Cont. Educ. Small Anim.*, vol. 14, pp. 921-931, 1992.
- [10] K. M. Tobias, "Rectal perforation, recto-cutaneous fistula formation, and entero-cutaneous fistula formation after pelvic trauma in a dog," *J. Am. Vet. Med. Assoc.*, vol. 205, pp. 1292-1296, 1994.
- [11] C. E. DeCamp, "Principles of pelvic fracture management," *Semin. Vet. Med. Surg. Small Anim.*, vol. 7, pp. 63-70, 1992.
- [12] H. Bragulla, K. D. Budras, C. Cerveny, H. E. Konig, H. G. Liebich, J. Maierl, C. Mulling, S. Reese, J. Ruberte, and J. Sautet, *Veterinary anatomy of domestic mammals*. Germany: Textbook and Colour Atlas. Schattauer GmbH, Holderlinstraße 3, D-70 174 Stuttgart, 2004.
- [13] J. A. Butler, C. M. Colles, S. J. Dyson, S. E. Kold, and P. W. Poulos, *Clinical radiology of the horse*, 3rd ed. Oxford: Blackwell Science, 2011.
- [14] D. Draffan, D. Clements, M. Farrell, J. Heller, D. Bennett, and S. Carmichael, "The role of computed tomography in the classification and management of pelvic fractures," *Vet. Comp. Orthop. Traumatol.*, vol. 22, pp. 190-197, 2009.
- [15] S. Ohlerth and G. Scharf, "Computed tomography in small animals – basic principles and state of the art applications," *Veterinary Journal*, vol. 173, pp. 254-271, 2007.
- [16] R. W. Webb, W. Brant, and N. Major, *Fundamentals of body Ct*, 3rd ed. Philadelphia: W.B. Saunders, 2005.

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