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Sacroiliac luxations in cats: Surgery or conservative treatment?

Luxación sacroilíaca en gatos: cirugía o tratamiento conservador?

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ABSTRACT

Sacroiliac luxations constitute an important part of hip fractures. In the treatment phase, a choice should be made between surgical and conservative treatment. Which treatment option will yield more effective results depends on many variable factors. In the present study, some of these factors were mentioned and their effects on treatment and outcomes were evaluated. A total of 61 cats, 26 female and 35 male, of various breeds and ages, were included in the study. The mean age of the cats included in the study was 16 months. The mean weight of the cats was 2.87 kg. Cases were categorized as ages, ≤6, 7-12, and ≥13 months of age. In addition, the success criteria of etiological causes, luxation type, and concomitant traumas on decision and outcomes were evaluated. Conservative treatment was preferred more in all age groups and success rates were higher than those of surgery. Conservative treatment was preferred in both genders, and the recovery rate was higher in males than that in females. Regardless of the cause of the trauma, more conservative treatment was preferred, and the rate of good recovery was higher in high-rise falls. Even if there was traumatic injury in addition to sacroiliac luxation, conservative treatment was preferred and the rate of good recovery was higher in cases without concomitant traumatic injury. As a result; age, gender, luxation type and concomitant traumatic injury were not statistically significant on treatment choice. However, good recovery was statistically significant in cases without concomitant traumatic injury.

Key words: Cat; sacroiliac luxation; surgical treatment; conservative treatment

RESUMEN

Las luxaciones sacroilíacas constituyen una parte importante de las fracturas de cadera. En la fase de tratamiento, se debe elegir entre tratamiento quirúrgico y conservador. La opción de tratamiento que producirá resultados más efectivos depende de muchos factores variables. En el presente estudio se mencionaron algunos de estos factores y se evaluaron sus efectos sobre el tratamiento y los resultados. Se incluyeron en el estudio un total de 61 gatos, 26 hembras y 35 machos, de varias razas y edades. La edad media de los gatos incluidos en el estudio fue de 16 meses. El peso medio de los gatos fue de 2,87 kg. Los casos se categorizaron en edades de ≤6; 7-12 y ≥13 meses de edad. Además, se evaluaron los criterios de éxito de las causas etiológicas, el tipo de luxación y los traumas concomitantes en la decisión y los resultados. El tratamiento conservador se prefirió más en todos los grupos de edad y las tasas de éxito fueron superiores a las de la cirugía. Se prefirió el tratamiento conservador en ambos sexos, y la tasa de recuperación fue mayor en los machos que en las hembras. Independientemente de la causa del trauma, se prefirió un tratamiento más conservador y la tasa de buena recuperación fue mayor en las caídas desde gran altura. Incluso si existía lesión traumática además de la luxación sacroilíaca, se prefirió el tratamiento conservador y la tasa de buena recuperación fue mayor en los casos sin lesión traumática concomitante. Como resultado a la edad, el sexo, el tipo de luxación y la lesión traumática concomitante, no fueron estadísticamente significativos en la elección del tratamiento. Sin embargo, la buena recuperación fue estadísticamente significativa en los casos sin lesión traumática concomitante.

Palabras clave: Gato; luxación sacroilíaca; tratamiento quirúrgico; tratamiento conservador

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INTRODUCTION

Hip consists of ilium, ischii, pubis, sacrum and first coccygeal vertebras [26]. The medial surface of the ilium articulates with the sacrum and forms the sacroiliac joint, which is one of the weight-bearing structures of the pelvis [8]. Sacroiliac joint injuries in cats *(Felis catus)* generally occur together with fractures in other bones forming the pelvis and hind extremity fractures [4, 8]. Although pelvic fractures are common in cats, they account for approximately 32% of all bone fractures. 59-93% of pelvic fractures in cats are sacroiliac luxation (SIL) and 27-46% of them are bilateral [3, 18, 26]. From an etiological point of view, hip fractures occur mostly due to high-rise falls, traffic accidents, gunshot wounds, bite-related injuries and tumoral formations [1, 14, 25]. The standard diagnostic method for evaluating cases with suspected trauma is radiographic examination. X-ray images are taken in laterolateral, ventrodorsal and oblique positions. Since the hip is similar to a box in structure, it is highly likely that more than one bone will be affected in case of a trauma [1, 14, 26]. Treatment options are conservative treatment (CT) or surgical treatment (ST) [8, 24]. At the decision stage, the patient should be evaluated clinically and radiographically, and the selection of these cases is very important [8, 18]. While CT is recommended in SIL where there is no or minimal displacement, no neurological damage, no narrowing of the pelvic canal, and minimal pain [2, 16, 18]. ST can be recommended for displaced luxations that narrow the pelvic canal [8]. Various methods such as lag screw, tension band, transiliac pin/screw and transiliosacral pin stabilization are used as surgical methods [18]. CT consists of cage rest for 2-4 weeks (wk), analgesia, and monitoring of urination and defecation. Complications that may be encountered in CT are narrowing of the pelvic canal as a result of displacement of pelvic fragments and prolongation of the recovery period [3].

The current study, investigated the effects of the treatment option on the outcome regardless of the surgical technique used in cats diagnosed with SIL, and also evaluated the effects of age, gender, etiology, luxation type and concomitant traumatic injury on the outcome. Thus, it was revealed whether variable factors contribute to the decision-making process for ST and CT in SIL.

MATERIALS AND METHODS

The study was carried out at Hatay Mustafa Kemal University Veterinary, Health, Practice and Research Hospital. A total of 61 cats of various breeds and different age groups, 26 female and 35 male, were included in the study. The mean weight of the cases was 2.87 kilograms (kg). The cases were categorized according to their ages as ≥6, 7-12, and ≥13 months. While the cases were etiologically were classified as high-rise falls, motor vehicle accidents and unknown causes, they were categorized as as unilateral and bilateral in terms of luxation type. Concomitant traumatic injuries are listed in TABLE I, but the cases were categorized as present or absent in the statistical evaluation. Treatment options were determined as ST and CT regardless of the surgical technique applied. In the evaluation of the outcome, it was used a modified version of classification by Ergin *et al*. and classifed cases as good, moderate and poor [8]. The patients were followed-up for 4-6 wk, taking into account the fracture healing process [3,20]. The cats with the complaint of hind limb lameness or inability to use their hind limbs were examined clinically and radiographically. Cats diagnosed with SIL as a result of radiographic examination (Intermedical, Basic 100-30®, Italy) were included in the study. While forming the hypothesis, it was emphasized whether ST and CT should be preferred primarily in cases with SIL included in the study. In addition, the effects of variable factors such as age, gender, etiology, concomitant traumatic injury and luxation type on the outcome were evaluated (TABLE I).

Statistical analysis

All statistical analyzes and Figures were performed using Stata 12/MP4 and GraphPad Prism 7. Descriptive statistics were presented as "Frequency (Percentage)". Chi-square test was performed to determine the relationship between SIL healing status, age, gender, etiology, luxation type, concomitant traumatic injury and treatment variables. In addition, the relationships between the treatment status of the cats, age, gender, etiology, luxation type and concomitant traumatic injury variables were also evaluated by chi-square analysis. Relationships between treatment status and other variables were presented graphically. $P<0.05$ was considered as significant in all analyses.

TABLE I
Data about cats with sacroiliac luxation

Case	Gender	Age| Weight	Etiology	Luxation type (B/U)	Concomitant traumatic injury	Treatment	Outcome
1	F	6.0 m|2.1 kg	High-rise fall	B	Acetabulum fracture	Surgery	Good
2	M	5.0 m|2.2 kg	MVA*	B	Acetabulum fracture	Conservative	Good
3	M	30.0 m|3.7 kg	MVA*	B	None	Conservative	Good
4	M	24.0 m|4.1 kg	Unknown	U	İlium + multiple femur fracture	Surgery	Moderate
5	M	9 m|3.5 kg	Unknown	B	İschii + acetabulum + pubic fracture	Surgery	Moderate
6	M	42 m|4.3 kg	High-rise fall	B	None	Surgery	Good
7	M	8 m|3.0 kg	High-rise fall	U	None	Conservative	Good
8	M	8.0 m|2.9 kg	High-rise fall	U	None	Conservative	Good
9	M	6.0 m|2.4 kg	Unknown	B	Ilium + acetabulum fracture	Surgery	Moderate

TABLE I **(cont...)**
Data about cats with sacroiliac luxation

Case	Gender	Age| Weight	Etiology	Luxation type (B/U)	Concomitant traumatic injury	Treatment	Outcome
10	F	12.0 m|5.2 kg	Unknown	U	Acetabulum fracture + hernia diaphragmatica	Conservative	Good
11	M	12.0 m|3.6 kg	MVA*	U	Acetabulum + collum femoris + ilium fracture	Surgery	Poor
12	F	12.0 m|3.7 kg	Unknown	U	Ilium fracture	Surgery	Good
13	F	1.5 m|0.5 kg	Unknown	B	Acetabulum fracture	Conservative	Good
14	F	2.0 m|0.7 kg	MVA*	U	Acetabulum + Monoplegia	Conservative	Poor
15	F	4.0 m|1.3 kg	MVA*	U	Ilium + supracondylar femur fracture	Conservative	Moderate
16	F	11.0 m|2.9 kg	Unknown	U	Ischii + pubic fracture	Conservative	Good
17	M	24.0 m|6.0 kg	MVA*	B	Acetabulum fracture	Conservative	Good
18	F	1.5 m|0.4 kg	MVA*	B	Hernia diaphragmatica	Conservative	Good
19	F	12.0 m|3.9 kg	High-rise fall	B	None	Conservative	Good
20	M	7.0 m|2.0 kg	High-rise fall	U	Collum femoris fracture	Surgery	Good
21	F	36.0 m|4.5 kg	MVA*	B	None	Surgery	Good
22	M	36.0 m|3.8 kg	High-rise fall	U	None	Conservative	Good
23	M	12.0 m|3 4 kg	High-rise fall	U	None	Conservative	Good
24	M	12.0 m|3.0 kg	Unknown	U	Femur fracture	Conservative	Good
25	M	12.0 m|2.7 kg	Unknown	B	İschii fracture	Conservative	Moderate
26	F	180.0 m|4.6 kg	Unknown	U	None	Conservative	Good
27	F	3.0 m|0.9 kg	High-rise fall	U	Ilium fracture + collum femoris fracture + monoparesis	Conservative	Poor
28	F	60.0 m|5.7 kg	High-rise fall	U	Humerus + pubic fracture	Conservative	Moderate
29	M	4.0 m|1.1 kg	High-rise fall	U	Bilateral tibia + ischii fracture	Conservative	Moderate
30	F	9.0 m|2.0 kg	MVA*	B	Caudal vertebral fracture + symphysis pubis fracture + paraplegia	Surgery	Poor
31	F	7.0 m|1.4 kg	MVA*	U	Bilateral ischii fracture	Conservative	Good
32	F	7.0 m|1.6 kg	High-rise fall	U	Ilium + fibula + bilateral tibia + ischii fracture	Surgery	Moderate
33	M	12.0 m|2.8 kg	MVA*	B	None	Conservative	Good
34	F	24.0 m|3.7 kg	High-rise fall	U	Ilium + tibia fracture	Conservative	Good
35	F	12.0 m|3.9 kg	Unknown	B	Acetabulum fracture	Surgery	Good
36	F	4.0 m|1.3 kg	Unknown	U	Acetabulum fracture + inguinal hernia	Conservative	Moderate
37	F	8.0 m|2.1 kg	MVA*	B	T10-11 level bullet core	Conservative	Poor
38	F	6.0 m|1.8 kg	MVA*	B	None	Conservative	Moderate
39	M	12.0 m|4.7 kg	MVA*	U	Ilium fracture	Conservative	Good
40	M	12.0 m|3.2 kg	MVA*	B	Ilium + femur fracture	Conservative	Moderate
41	M	12.0 m|3.0 kg	Unknown	U	None	Conservative	Good
42	M	6.0 m|2.3 kg	MVA*	U	None	Conservative	Good
43	M	10.0 m|3.0 kg	MVA*	U	Femur + collum femoris + acetabulum fracture	Surgery	Good
44	M	10.0 m|4.2 kg	High-rise fall	U	None	Conservative	Good

***TABLE I* (cont...)**
Data about cats with sacroiliac luxation

Case	Gender	Age| Weight	Etiology	Luxation type (B/U)	Concomitant traumatic injury	Treatment	Outcome
45	M	24.0 m|3.0 kg	Unknown	B	Ischii fracture	Conservative	Good
46	M	1.0 m|0.3 kg	High-rise fall	B	Acetabulum fracture	Conservative	Good
47	M	3.0 m|0.6 kg	High-rise fall	U	Pubic fracture	Conservative	Good
48	M	12.0 m|3.5 kg	Unknown	U	None	Conservative	Good
49	M	36.0 m|3.2 kg	High-rise fall	U	Sacrum + neurological damage	Conservative	Poor
50	M	24.0 m|6.1 kg	High-rise fall	U	Bilateral tibial fracture	Surgery	Good
51	M	4.0 m|1.1 kg	MVA*	U	None	Conservative	Good
52	M	48.0 m|4.3 kg	MVA*	B	None	Surgery	Good
53	M	5.0 m|1.9 kg	MVA*	B	Ilium + acetabulum fracture	Surgery	Moderate
54	F	3.0 m|1.0 kg	MVA*	B	Acetabulum fracture	Conservative	Good
55	F	11.0 m|4.3 kg	MVA*	U	None	Conservative	Good
56	F	9.0 m|2.8 kg	High-rise fall	U	Ilium fracture	Surgery	Good
57	F	12.0 m|3.9 kg	Unknown	U	Pubic fracture	Surgery	Good
58	M	12.0 m|2.9 kg	Unknown	U	Femur fracture	Surgery	Good
59	F	6.0 m|2.1 kg	High-rise fall	U	Ilium fracture	Surgery	Good
60	M	12.0 m|2.2 kg	High-rise fall	U	Ilium fracture + neurological damage	Conservative	Poor
61	M	12.0 m|2.7 kg	High-rise fall	B	Sacrum fracture	Conservative	Good

F: Female, M: Male, m: Months, kg: Kilograms, B: Bilateral, U: Unilateral, *: Motor vehicle accident

RESULTS AND DISCUSSION

A total of 61 cats, 26 females and 35 males, of various ages and breeds were included in the study. In general, the cases brought to the hospital reported anamnesis of high-rise fall and traffic accident. In some cases, the cause of the lameness or inability to use his feet was unknown.

ST was applied to 34.6% (9 cases) of female cats with SIL, and conservative treatment was applied to 65.4% (17 cases). For the female cats, who underwent ST, the results were good in 77.8% (7 cases) of female cats, moderate in 11.1% (1 case), and poor in 11.1% (1 case). Of the female cats treated conservatively, 58.8% (10 cases) had good results, 23.5% had moderate results, and 17.7% (3 cases) had poor results. ST was applied to 31.4% (11 cases) of male cats with SIL, and CT was applied to 68.6% (24 cases) (FIG. 1). Of the surgically treated male cats, 54.5% (6 cases) had good results, 36.4% had moderate results, and 9.1% (1 case) had poor results. Results were good in 79.2% (19 cases) of male cats treated conservatively, moderate in 12.5% (3 cases), and poor in 8.3% (2 cases). When these data were evaluated, ST was found to be more successful in female cats, while the success rate of CT was found to be higher in male cats.

There was no significant difference in terms of species among the cats included in the study, and the mean age was 16.04 months (1-180 months). Cats were divided into three categories as ≤ 6, 7-12 and ≥ 13 months old. ST was applied in 22.2% (4 cases) and CT was applied in 77.8% (14 cases) of cats under 6 months of age with SIL. Good results were obtained in 50% (2 cases) and moderate results in 50% (2 cases) of cats under 6 months of age who underwent ST. The results were good in 57.1% (8 cases), moderate in 28.6% (4 cases), and poor in 14.3% (2 cases) of cats under 6 months of age treated with CT. According to these results, the success of CT seems to be higher in cats younger than 6 months with SIL. ST was applied to 36.6% (11 cases) of cats with SIL between 7-12 months, and CT was applied to 63.4% (19 cases). Good results were obtained in 63.6% (7 cases) of cats aged 7-12 months who underwent ST, moderate in 18.2% (2 cases), and poor in 18.2% (2 cases). Good results were obtained in 79% of cats aged 7-12 months who received CT, moderate in 10.5% (2 cases), and poor in 10.5% (2 cases). In this case, it can be said that the success of CT is higher in cases with SIL between 7-12 months. ST was applied in 38.5% (5 cases) of cats older than 13 months of age with SIL, and CT was applied in 61.5% (8 cases). Good results were obtained in 80% (4 cases) and moderate results in 20% (1 case) of cats older than 13 months who underwent ST. Good results were obtained in 75% (6 cases) of cats older than 13 months of age who received CT, moderate results in 12.5% (1 case), and poor results in 12.5% (1 case). According to these data, the success of ST seems to be higher in cats older than 13 months of age with SIL.

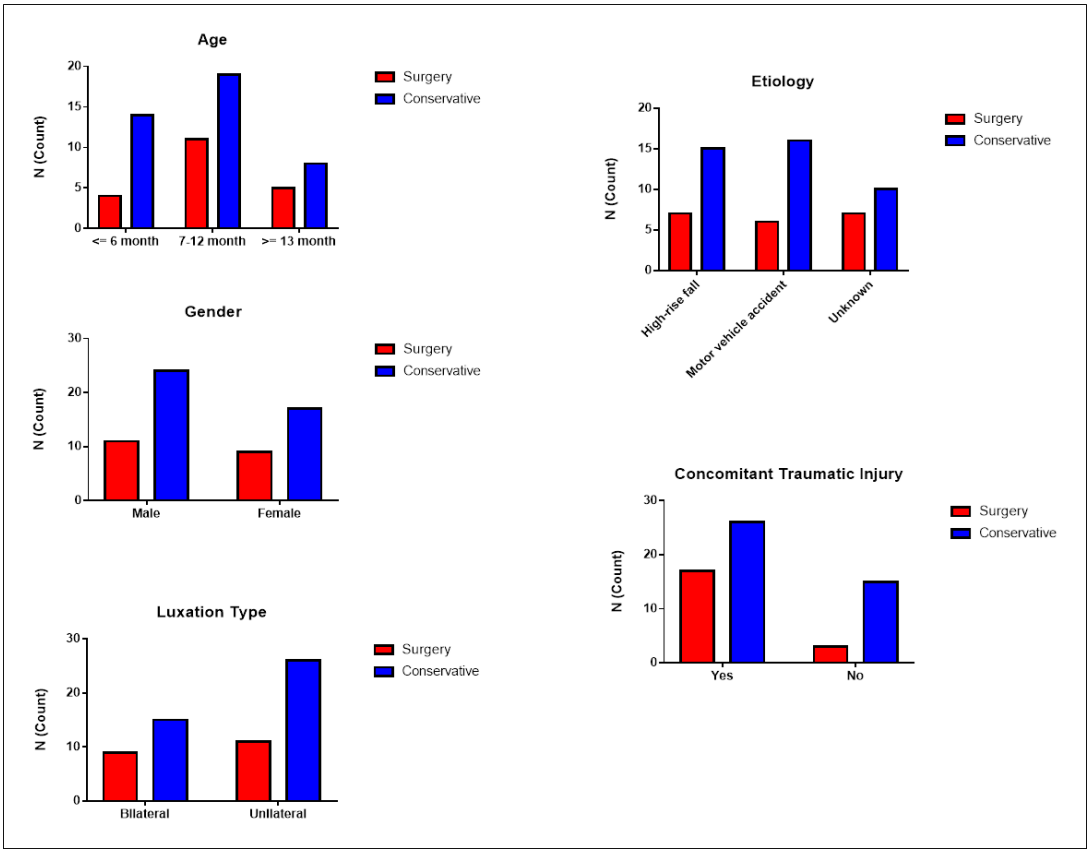

FIGURE 1. Graphical representation of the relationships between different parameters and treatment

Of the SIL in cats, 36.1% (22 cases) were caused by falling from a height, 36.1% (22 cases) were caused by motor vehicle accidents, and 27.8% (17 cases) were due to an unknown reason. ST was applied to 31.9% (7 cases) of cases with SIL as a result of falling from a height, and CT was applied to 68.1% (15 cases). Good results were obtained in 85.7% (6 cases) of cases that fell from a height and underwent ST, and moderate results were obtained in 14.3% (1 case). Good results were obtained in 66.7% (10 cases) of the cases that fell from a height and were treated with CT, moderate in 13.3% (2 cases), and poor in 20% (3 cases). In this case, the success of ST seems to be higher in SIL caused by falling from a height. ST was applied to 27.3% (6 cases) of the cases with SIL as a result of a motor vehicle accident, and CT was applied to 72.7% (16 cases). Good results were obtained in 50% (3 cases) of the cases who had a motor vehicle accident and underwent ST, moderate in 16.6% (1 case), and poor in 33.3% (2 cases). Good results were obtained in 68.8% (11 cases) of the cases who had a motor vehicle accident and were treated with CT, moderate results were obtained in 18.7% (3 cases) and poor results in 12.5% (2 cases) of the cases.

According to these results, the success of CT seems to be higher in SIL occuring as a result of motor vehicle accident. ST was applied to 41.1% (7 cases) of the cases that developed SIL due to unknown reasons, and CT was applied to 58.9% (10 cases). Good results were obtained in 57.1% (4 cases) and moderate results in 42.9% (3 cases) of the patients who underwent ST in SIL that occured due to unknown reasons. In SIL of unknown cause, good results were obtained in 80% (8 cases) and moderate results in 20% (2 cases) of the cases that were treated by CT (TABLE I).

Unilateral SIL occurred in 37 and bilateral SIL in 24 of the cases exposed to trauma. It was decided to operate on 37.5% (9 cases) of cases with bilateral SIL, and performed CT in 62.5% (15 cases). Good results were obtained in 55.5% (5 cases) of cases treated by ST in bilateral SIL, moderate in 33.3% (3 cases), and poor in 11.2% (1 case). In bilateral SIL, good results were obtained in 73.3% (11 cases) of the cases treated by CT, moderate in 20% (3 cases), and poor in 6.7% (1 case). ST was decided in 29.8% (11 cases) and CT was decided in 70.2% (26 cases) of unilateral SIL cases. In unilateral SIL, results were good in 72.7% (8 cases), moderate in 18.2% (2 cases), and poor in 9.1% (1 case) of cases treated by ST. In unilateral SIL, good results were obtained in 69.2% (18 cases) of the cases treated by CT, moderate in 15.4% (4 cases), and poor in 15.4% (4 cases). When the results of ST cases in unilateral and bilateral SIL are compared, success seems to be higher in unilateral SIL. On the other hand, when it is compared with the results of cases treated by CT in unilateral and bilateral SIL, the effects on the outcome were similar (TABLE I).

While there was at least one concomitant traumatic injury (TI) in 70.4% (43 cases) of a total of 61 cases with SIL, there was no accompanying TI in 29.6% (18 cases). There was a significant correlation between the TI accompanying SIL and the outcome (P<0.05, TABLE II). ST was applied to 39.5% (17 cases) of cases with TI accompanying SIL, and CT was applied to 60.5% (26 cases). Good results were obtained in 58.8% (10 cases) of cases with concomitant

TABLE II
The effect of age, gender, etiology, luxation type, concomitant trauma and treatment on outcome (N (Percentage))

Variables		Outcome			*P* value
		Good	Moderate	Poor	
Age	less than or equal to 6 months	10 (55.6%)	6 (33.3%)	2 (11.1%)	0.344
	7 to 12 months	22 (73.3%)	4 (13.3%)	4 (13.3%)	
	greather than or equal to 13 months	10 (76.9%)	3 (23.1%)	0 (0)	
Gender	Male	25 (71.4%)	8 (22.9%)	2 (5.7%)	0.452
	Female	17 (65.4%)	5 (19.2%)	4 (15.4%)	
Etiology	High-rise fall	16 (72.7%)	4 (18.2%)	2 (9.1%)	0.391
	Motor vehicle accident	14 (63.6%)	4 (18.2%)	4 (18.2%)	
	Unknown	12 (70.6%)	5 (29.4%)	0 (0)	
Luxation type	Bilateral	16 (66.7%)	6 (25.0%)	2 (8.3%)	0.831
	Unilateral	26 (70.3%)	7 (18.9%)	4 (10.8%)	
Concomitant traumatic injury	Yes	25 (58.1%)	12 (27.9%)	6 (14.0%)	0.019
	No	17 (94.4%)	1 (5.6%)	0 (0)	
Treatment	Surgery	13 (65.0%)	5 (25.0%)	2 (10.0%)	0.880
	Conservative	29 (70.7%)	8 (19.5%)	4 (9.8%)	

TI and ST, moderate in 29.4% (5 cases), and poor in 11.8% (2 cases). Good results were obtained in 57.7% (15 cases) of the cases with concomitant TI and CT, moderate in 23.1% (6 cases), and poor in 19.2% (5 cases). ST was applied to 16.6% (3 cases) of cases without TI accompanying SIL, and CT was applied to 83.4% (15 cases). The outcome of all (100%) patients who did not have concomitant TI and underwent ST was good. Of the cases without concomitant TI and treated by CT, 93.3% (14 cases) recovered well, and 6.7% moderately. In comparison, although the success rates of ST and CT applied in cases accompanied by TI are at similar and average values, the success seems to be very high regardless of the treatment option applied in SIL without TI. FIG.2 shows radiographic images (Intermedical, Basic 100-30®, Italy) of cats with SIL and CT and ST.

Out of a total of 61 cases with SIL, 20 were treated by ST and 41 were treated by CT. Surgically treated cases had 65% good results, 25% moderate results and 10% poor results. Out of all the cases conservatively treated 70.7% had good results, 19.5% had moderate results and 9.8% poor results. Although it is not statistically significant, it may be clinically significant that CT results in higher success than ST. However, ST is generally preferred in cases with collapse in the pelvic canal.

In this study, the effectiveness of age, gender, etiology, luxation type, concomitant traumatic injury and treatment option on the outcome of SIL in cats is evaluated. In addition, the role of the variable factors included in the study in the treatment option was investigated.

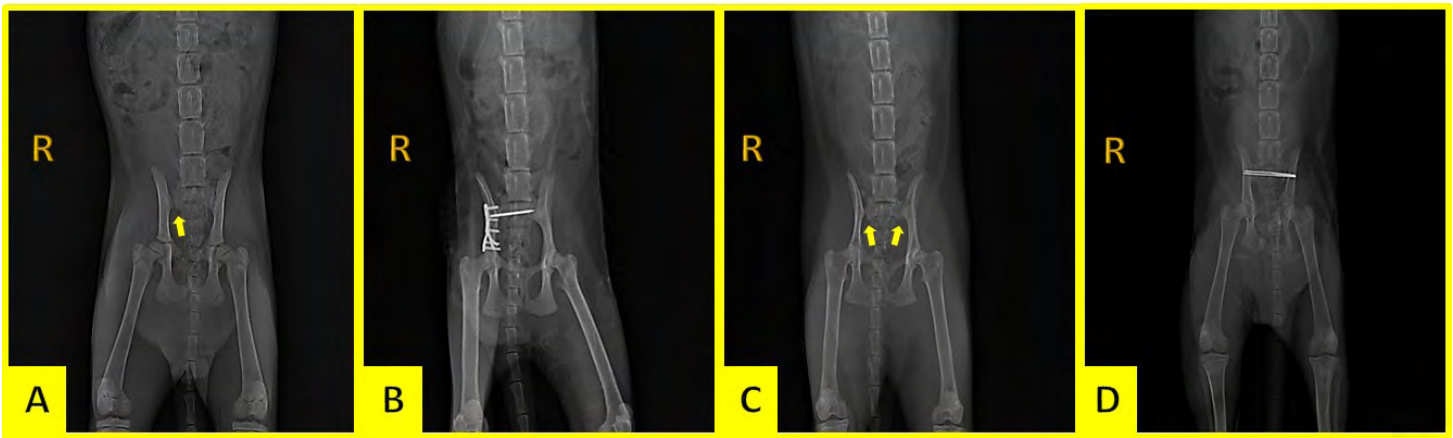

FIGURE 1. A: X-ray image of unilateral SIL in a cat recovering with cage rest B: Postoperative X-ray image of a cat with unilateral SIL C: X-ray image of bilateral SIL in a cat recovering with cage rest D: Post-operative X-ray image of a cat with bilateral SIL

Except for the accompanying traumatic injury, there was no statistical significance. However, clinically significant data were obtained.

SIL, sacroiliac fracture, or SIL fracture are terms used to describe the traumatic separation of the iliac wing from the sacrum, depending on the localization of the lesion. SIL is an expression generally used in young animals [9]. Since most of the cases (78.6%) included in this study were younger than 1 year old, separation of the ilium wing from the sacrum was defined as SIL. In their study, Raffan *et al*. studied cats with SIL aged between 10 and 72 months [19]. In the present study, the age spectrum was wider and ranged between 1 month to 180 months.

While Ergin *et al.* classified their results as very good, good and satisfactory [8], in the present study, we modifed this classification of healing results to include good, moderate and poor.

Shales *et al.* reported that 67.5% of SIL in 40 cats were unilateral and 32.5% were bilateral [20]. Aksoy *et al.* also stated that sacroiliac separations are mostly unilateral [1]. In their study on 19 cats, Raffan *et al.* emphasized that SIL were highly unilateral [19]. The results in this study are similar to those of the researchers. Unilateral SIL were 60.7%, while bilateral SIL were 39.3%. Based on this, the unilateral formation of SIL in the present study, supports other studies.

Fauron and Déjardin stated that SIL in older animals are usually accompanied by orthopedic damage [9]. In direct proportion to this, in the present study, 53.8% of the cases over the age of 1 had at least one injury accompanying SIL, and ST was decided in 39.5% of these cases and CT in 60.5%. Shales *et al.* reported a high rate (82.5%) of concomitant damage in cases with SIL [20]. This rate was also high in the present study, and 70.4% of the cases with SIL had at least one accompanying TI. On the other hand, the rate of good recovery in cases not accompanied by traumatic injury was quite high (94.4%) compared to the cases accompanied by TI In this study, in the cases accompanied byTI , the rate of cases with good results in ST and CT was very close to each other.

Johnson and Hulse [11] and Silveira *et al*. [22] stated that surgical methods should be used in the treatment of SIL. In contrast, Mesquita *et al.* suggested CT for SIL [14]. In the present study, it was revealed that many factors may affect the results, even if they are not statistically significant (see the findings). Various fixation techniques have been described in the ST of SIL in cats [5,10,12, 15,19, 20]. However, in the present study, the effect of ST and CT on the outcome was evaluated at the decision-making stage, regardless of the technique used, and it was determined that good recovery rates were higher in cases treated with CT, regardless of variable factors (TABLE II).

On the other hand, good and moderate recovery results are almost the same in cases with ST and CT. Fauron and Déjardin stated that surgical difficulties and potential complications may affect the surgeon's decision [9]. Raffan *et al*. emphasized that ST provides faster recovery than CT, relieves pain and eliminates existing neurological deficits [19]. In addition, there are some authors who support this view [7, 13, 21-23]. Raffan *et al.* reported that neurological damage developed in almost half of the cases with SIL, which they included in their study, and they stated that neurological damage became permanent in some of the cases with neurological damage [9]. Some authors emphasized that apart from TI , screws coming out of the sacrum, especially in cases of ST carry the risk of iatrogenic damage to the cauda equina dorsally, lumbosacral intervertebral disc cranially, lumbosacral plexus ventrally, and sacral vessels medially [6, 17, 21-22]. In cases that are considered to be treated surgically, the possibility of developing these complications should be considered. In this study, 6 cases had neurological damage. CT was applied to 5 cases and ST was applied to one case. However, the results were poor in all of them. In the present study, the results of ST and CT options on recovery were similar. Considering factors such as surgical difficulties, complications, cost, and mortality, CT can be decided if there is no accompanying TI.

Fauron and Déjardin stated that CT can give good results, yet when choosing this treatment method, nerve damage, pain, time elapsed, instability, accompanying orthopedic and soft tissue damage should be considered [9]. However, they emphasized that CT could be chosen due to financial concerns or chronic lesions. In the present study, 63.4% of 41 cats treated by CT had concomitant TI. However, only concomitant TI was not taken into account in these cases that were treated by CT. To make a conclusion in favor of CT at the stage of deciding on the treatment, loss of luxation level, chronicity, presence of neurological damage, support of the hip area with strong muscles, low weight of the cats, general condition of the case and financial reasons were also important criteria for the researchers. .

CONCLUSIONS

As a result, there are many variable factors that affect the outcome at the decision-making stage. It was discussed some of them one by one. Although there were not statistically significant differences in terms of all of the variables, some diffrences could be clinically significant. Age, gender, luxation type and etiology were not statistically significant in deciding the treatment. However, especially in cases without TI, recovery rates in CT showed statistical significance. It has been concluded that CT can be recommended for SIL in cats that are not accompanied by TI regardless of variable factors.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in the research.

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