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Research Article

LOCKING "T" PLATE FOR THE REPAIR OF DISTAL RADIUS FRACTURES IN DOGS

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ABSTRACT

The present study was conducted to evaluate the efficacy of Locking "T" plates for the treatment of distal radius fractures in six dogs. Radius fractures were seen most in non-descript, male dogs of less than one year of age. The left radius was frequently affected among which closed, oblique, distal diaphyseal fractures were common. The Locking "T" plate provided adequate stability to the fracture fragments. Immediate post-operative radiographs showed proper reduction and good alignment of the fractured fragments aiding the early bone healing. The locking T plate was easy to apply, shown improvement in weight bearing and angulation of the affected limb with faster wound healing with radiographically noticeable bridging callus.

Keywords: Dog, Locking T plates, Radius fracture

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A fracture is a complete or incomplete break in the continuity of a bone or cartilage which usually results from traumatic injury. Forelimb fractures are challenging in orthopaedic surgery as dogs bear most of their weight on the thoracic limbs (Carrig, 1983; Fox, 1997).

Locking T-plate was a relatively new method for fixation of distal diaphyseal/simple metaphyseal fractures in dogs. The locking compression plate combines the conventional screw hole, which uses non-locking screws, and a locking screw hole, which uses locking head screws. This allows for more versatility in the application of the plate (Miller and Goswami, 2007).

MATERIALS AND METHODS

The present study was carried out for a period of one year (september 2020 to August 2021) among clinical cases of dogs confirmed for radius and ulna fracture. All the dogs (n=6) were stabilized with Locking "T" Plate and the outcome was evaluated. The physiological and hematobiochemical parameters were evaluated at the day of surgery and followed by 3rd, 5th, 7th, 14th, 28th, 45th and 60th day after the surgery and radiographical evaluations were done immediately after the surgery and on 0, 7th, 14th, 28th, 45th and 60th day post-surgery.

Six dogs of different age, sex and body weight selected for the study were examined completely prior to surgery and they were also evaluated for any life-threatening conditions.

Anesthesia: All the dogs were pre-medicated with inj. atropine sulphate at the dose rate of 0.04 mg/Kg B. wt. subcutaneous and Xylazine hydrochloride at the dose rate of 1 mg/Kg B. wt. intramuscular. After 10-15 minutes, the general anesthesia was induced with intravenous administration of 2.5 % Thiopentone sodium at the rate of 12.5 mg/Kg B. wt. and maintained with the same to effect throughout the procedure.

The surgical site was prepared aseptically and the animal was placed in lateral recumbency with the affected limb placed upside. A linear incision was made on the skin at the cranial aspect of the affected limb at the fracture site and extended required length. With gentle manipulation, the fracture fragments were brought in apposition. Locking "T" plates of suitable size (2.7mm and 3.5mm) and length (7 holes and ten holes) were chosen depending upon the body weight of each dogs. The suitable size plate was placed on fracture site and was held with point reduction and selfcentring forceps weld with pointed reduction and self-centering forceps. Using suitable drill bits, holes were pre drilled one by one to the bone and screws length was confirmed using depth gauze. Then screws were fixed appropriately using octagonal screw driver, leaving a hole empty at the fracture site. The subcutaneous tissue was opposed by using no. 2-0 Polyglactin 910 in simple continuous suture pattern. The skin was closed using no. 2-0 Polyamide suture material in horizontal matters suture pattern.

Postoperatively, the surgical wound was dressed every alternate day with povidone iodine cream and bandaging was applied for one week.

Antibiotics: Inj. Ceftriaxone at the dose rate of 20 mg/Kg B. wt. was administered, once a day intramuscularly for seven days postoperatively and Inj. Meloxicam at the dose rate of 0.2 mg/Kg B. wt. once a day subcutaneously for three days. The activity of the dogs was restricted. A protective Elizabethan collar was used until skin sutures were removed. The sutures were removed on 10th

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Table 1. Mean ± SE values of Rectal temperature (0F), Heart Rate (Beats/minute), Respiratory rate (breaths /minute) and Pulse rate (Pulse/minute) in dogs

Days	Rectal Temperature Mean ± SE (ºF)	Heart rate Mean ± SE (Beats/minute)	Respiratory rate Mean ± SE (breaths/minute)	Pulse rate Mean ± SE (Pulse/minute)
Before the surgery	101.45±0.24	103.66±1.58	18.33 ±0.74	99.33 ±2.99
0	101±0.25	102.66±2.90	21.5 ±0.67	97.33 ±2.90
3	100.93±0.29	102.33±1.74	21 ±1.03	93.66 ±4.88
5	100.45±0.28	102.83±1.88	20.5 ±0.61	97.33 ±3.72
7	100.91±0.23	99.66±1.89	21.16 ±0.79	94 ±3.05
14	101.11±0.20	98.33±3.44	20.83 ±0.70	93.33 ±5.12
28	100.83±0.32	97.66±4.36	21.66 ±0.21	96 ±4.78
45	101.01±0.22	102.67±3.92	22 ±0.63	100 ±4.38
60	101.13±0.24	102±4.25	20.5 ± 0.61	97.66 ±5.85

Table 2. Mean±SE values of Haemoglobin, total erythrocyte count (10^6 cells/cumm) and total leukocyte count (10^3 cells/cumm) in dogs

Days	Haemoglobin (g/dl)	TEC (10^6 cells/cumm)	TLC (10^3 cells/cumm)
Before the surgery	14.70 ±0.713	7.00 ± 0.45	14.88 ± 0.50
0	14.18 ±0.922	7.02 ± 0.55	15.6 ± 0.73
3	13.61 ±1.45	7.05 ± 0.50	15.48 ± 0.83
5	13.61 ±1.45	7.16 ± 0.48	14.80 ± 0.72
7	13.5 ±0.92	7.45 ± 0.56	15.30 ± 0.96
14	13.76 ±0.84	7.52 ± 0.52	15.28 ± 0.75
28	13.83 ±0.83	7.51 ± 0.60	15.50 ± 1.41
45	13.43 ±0.58	7.36 ± 0.52	14.76 ± 0.66
60	13.36 ±0.74	7.38 ± 0.59	14.35 ± 0.67

postoperative day after complete examination of surgical wound site.

The efficacy of the treatment was evaluated based on physiological parameters, haemato-biochemical parameters, clinical and radiological evaluation. The parameters were recorded preoperatively, immediately after surgery, and on 3rd, 5th, 7th, 14th, 28th, 45th and 60th day. The lameness grading and radiographic evaluation was made preoperatively, immediately after surgery, and on 7th, 14th, 28th, 45th and 60th postoperative day. All the results were statistically analyzed by one-way Analysis of variance (ANNOVA), using computer based statistical programme Graph pad prism and interpreted as per the procedures described by Snedecor and Cochran (1996) to arrive at a conclusion.

RESULTS AND DISCUSSION

The mean±SE values of the pre-operative and post-operative rectal temperature, respiratory rate. heart rate, pulse rate, hemoglobin level, total erythrocyte count, total leucocyte count serum Alanine Amino transferase, serum creatinine subjected for Locking "T" plates for the treatment of distal radius fractures were recorded and these values were statistically non-significant ($P \leq 0.05$) (Table 1, 2 & 3). The findings of present study was in coordinance with the results of Srinivasa Murthy (2000), Mahesh

Table 3. Mean±SE values of Serum Creatinine (mg/dL) and Serum Aspartate Amino Transferase (IU/L) in dogs

Days	Serum Aspartate Amino Transferase (IU/L) (mean ± SE)	Serum Creatinine (mg/dl)(mean ± SE)
Before the surgery	33.18 ±1.05	0.93 ± 0.04
0	34.40 ±1.27	0.91 ±0.03
3	34.81 ±1.41	1.03 ±0.03
5	34.70 ±0.96	1.00 ±0.03
7	36.91 ±0.73	0.98 ±0.04
14	35.13 ±1.75	0.95 ±0.04
28	34.90 ±1.22	0.98 ±0.03
45	34.95 ±0.67	0.95 ±0.05
60	35.28 ±1.14	1.01 ±0.03

Table 4. Mean values of serum calcium and phosphorous during the study period

Day	Serum Calcium	Serum Phosphorous
Before the surgery	33.18 ±1.05	0.93 ± 0.04
0	9.25 ±0.21	5.72 ±0.20**
3	9.35 ±0.34	5.82 ±0.22**
5	9.58 ±0.38	5.86 ±0.19**
7	9.82 ±0.49**	6.11 ±0.18**
14	9.86 ±0.46**	5.96 ±0.12**
28	10.44 ±0.55**	6.41 ±0.11**
45	10.30 ±0.45**	5.56 ±0.15**
60	10.16 ±0.54**	5.21 ±0.09**

(The values marked with ** were significantly varied from before surgery)

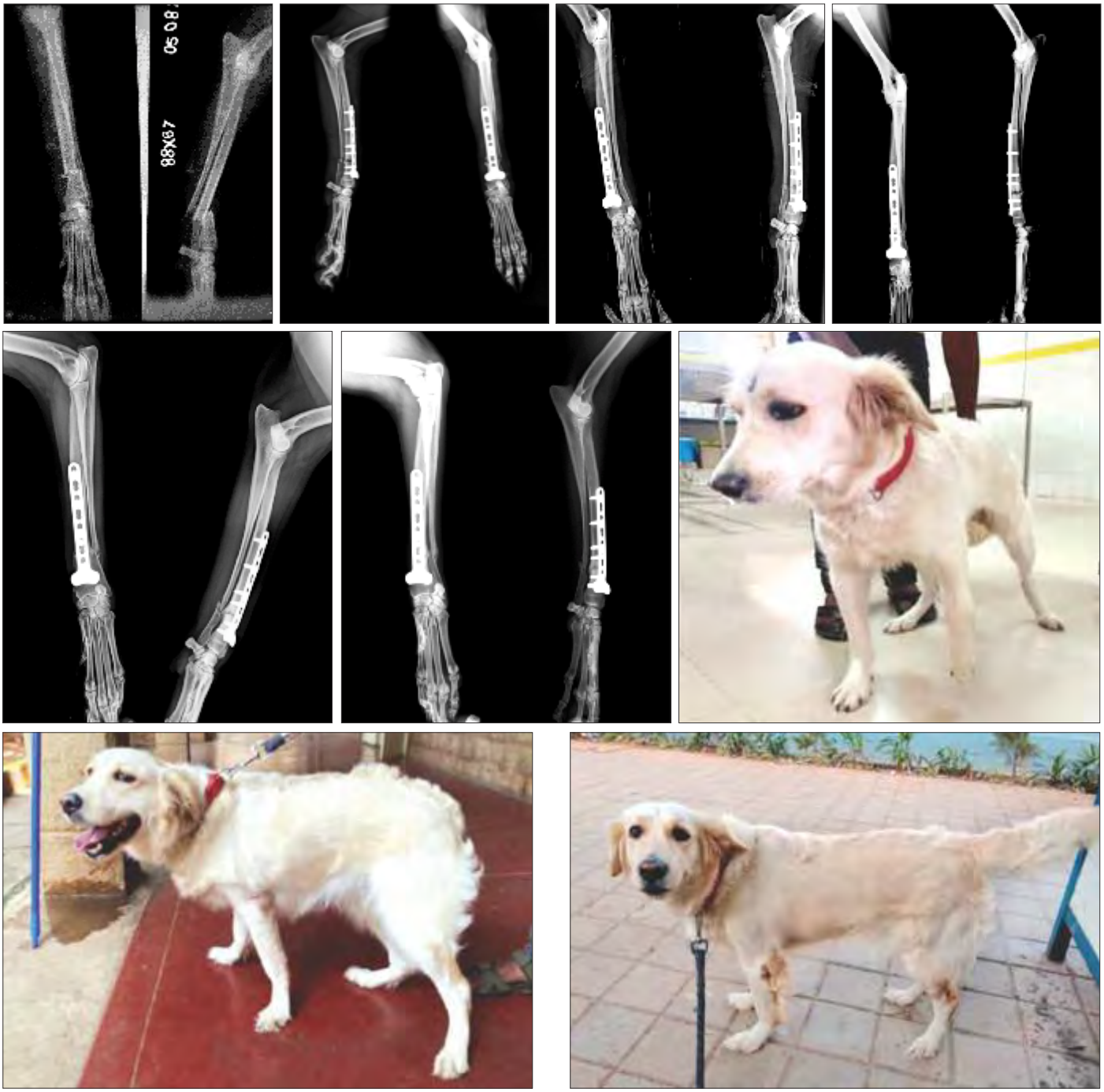

Plate 1 to 5. **(1)** Anterio-posterior (a&c) and medio-lateral (b&d) radiographic view of pre-operative and immediately after; **(2)** Anterio-posterior (a&c) and medio-lateral (b&d) radiographic view of post-operative radiograph on day-7 and 28; **(3)** Anterio-posterior (a&c) and medio-lateral (b&d) radiographic view of post-operative radiograph on day-45 and 60; **(4)** Affected limb of the animal before surgery; **(5)** Complete weight bearing on the operated limb after surgery on day 45 and 60

(2009), Patil *et al.* (2017), Nilajagi (2021) and Harshitha (2021).

The mean±SE values of pre-operative and post-operative serum calcium level and serum phosphorous level were recorded (Table 4). The mean values significantly increased from the pre-operative day upto 28th post-operative day, after which, the concentration gradually reduced till the 60th postoperative day. This could be due to increased osteoblastic activity at the fracture site, due to fracture healing. The gradual reduction after 28th post-operative day may be due to lowered level of extracellular calcium, thus stimulating the release of calcium metabolizing hormones, as documented by Komnenou *et al.* (2005). All the values recorded appeared to be within the normal physiological levels. Findings were in concurrence with Singh *et al.* (2017) and Kumar *et al.* (2018).

In the present study pre-operatively, all the dogs

showed lameness of grade V (does not bear weight on limb at rest or while walking). On 7th postoperative day five dogs had Grade IV and one dog had Grade III indicating reducing pain at the surgical site and healing process was in progress. On 15th postoperative day four dogs showed Grade III lameness (Partial weight bearing at rest and while walking) two dog showed lameness of Grade II (Normal weight bearing at rest, favors affected limb while walking) evidenced by partial weight bearing on the affected limb while walking. On 28th postoperative day all the dogs had grade II lameness. All the dogs showed complete weight bearing on the 45th day (plate 5) that was Grade I lameness (barely detectable lameness). These findings were in accordance with those of Rani *et al.* (2012) and Manjunath (2010).

The radiographs of the affected radius bone were taken prior to and immediately after the surgery in all the dogs to evaluate reduction of the fractured fragments and to evaluate the plate and screw placement in the bone. Rao *et al.* (2017). There was no alteration in the alignment of the Locking "T" plate used throughout the study. On 14th post-operative day, there was decrease in the fracture gap with evidence of periosteal reaction which was indicative of the fracture healing process. On 45th post-operative day, there was adequate apposition of the fracture segments with fracture line barely discernible and there was moderate to marked bridging of the fracture site indicating the process of fracture healing upto the mark and by 60th post-operative day in all the cases the fracture line was indistinctly obliterated (Plate1, 2, 3) indicating satisfactory healing of fracture. Fathy *et al.* (2018) observed partial disappearance of fracture gap at 8th week post operatively, but complete disappearance of fracture gap was observed on 16th post-operative week. Locking "T" plates were not removed after the fracture healing.

CONCLUSION

In conclusion, locking "T" platting technique was found to be satisfactory for the repair of distal radius fractures in dogs. The technique was easy to apply; and provided satisfactory stability to the fractured fragments, and helped in early usage of limbs, thereby reducing the muscular atrophy and improving the quality of the life.

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