Use of a Transarticular Circular Fixator Construct for Immobilisation of the Tarsocrural Joint Following Common Calcaneal Tenorraphy in Four Dogs

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ABSTRACT

A transarticular circular fixator construct was used to immobilize the tarsocrural joint following common calcaneal tenorraphy in four dogs. The time from injury to surgery ranged from three to eight months. The circular fixator construct allowed for controlled transition from immobilisation to movement over a period of 8 weeks. No long lasting complications were associated with using the circular fixator and all dogs had a normal gait at final follow up.

INTRODUCTION

Rupture of the common calcaneal tendon (CCT) is one of the most common tendon injuries in dogs. The CCT has three main units – the gastrocnemius tendon, the superficial digital flexor tendon and the common tendons of biceps femoris, semitendinosus and gracillis. Of these the gastrocnemius tendon is the most frequently ruptured component. The treatment of this disabling injury is challenging, often requiring anatomical reconstruction[1]. Autologous supplementation of repair is often required with chronic ruptures when there is insufficient tendon tissue available[2,3]. Post operative immobilisation of the tarsocrural joint is necessary due to the constant strain forces of weight bearing interrupting healing, so immobilisation using casts, calcaneotobial screw, external fixator or orthortics have been used[4,5]. Progressive controlled weight bearing after immobilisation has been the accepted management protocol as described in the human literature[6]. However there are many techniques for the gradual transition from immobilisation to normal limb use and complications occur regularly with all methods of immobilisation[4]. Our clinical goal with these cases was to demonstrate that a circular fixator construct can be used to manage postoperative care of chronic CCT ruptures because it can be easily altered from rigid to flexible fixation status.

METHODS

A transarticular circular fixator construct was used to immobilize the tarsocrural joint in four dogs following common calcaneal tenorraphy between 2005 and 2008. The

selection criterion was any dog over 25 Kg that was admitted for treatment of chronic CCT rupture. CCT rupture was defined as chronic when the interval from initial injury to presentation was three months or greater. The minimum follow up data was 8 months, and the outcome assessment was by two different surgeons for each dog, where one was always the operating surgeon. Outcome was assessed on the basis of the clinical examination and assigned to one of the following gaits as failure, lame, or normal, and for hock joint position as hyper flexed, flexed, and normal. The ruptures were classified according to the method of Meutstege[7]. There were 3 dogs with a unilateral rupture and one with bilateral injuries (case 2). All dogs had been treated previously by the referring veterinary surgeon using conservative methods involving splints, external fixators, casts and bandages.

General anaesthesia was induced and maintained using isoflurane (Forane; Abbott Laboratories). Meloxicam (Metacam: Boerhinger Ingelheim) and buprenorphine (Temgesic; Reckitt and Coleman) were used to provide analgesia pre and post operatively. Following debridement of excess scar tissue, the tendon was repaired using a locking loop suture pattern. Autologous tissue was used from the local tendon in 2 cases (case 2 and 3) by creating a z advancement procedure to the shorten the tendon and appose the ends with the basketball (cruciate) and locking loop suture pattern. Following repair a circular fixator with two hinges (medial and lateral) or threaded bars and one or two standard threaded bars (caudal +/-cranial) was applied using 1.6mm tensioned wires proximal and distal to the tarsocrural joint. The hinges were locked at the time of surgery and centered over the tarsocrural joint. After predrilling with a 1.1 mm drill bit, a 1.6 mm olive wire was then inserted into the calcaneus from the caudal aspect and then carried on into the distal tibia with the tarsocrural joint clamped in extension. The cranial end of the olive wire was attached to a post on the proximal ring and tightened (Fig 1). After 4 weeks the olive wire was cut from the post and the standard bars cut at the level of the ring and replaced with locked hinges if not present already (Fig 2). Two weeks later the olive wire was removed completely and the hinges were loosened. The remaining fixator construct was removed 2 weeks later. A Robert Jones bandage was then applied for 2 weeks.

Meloxicam (Metacam: Boerhinger Ingelheim) and buprenorphine (Temgesic;

Figure 1

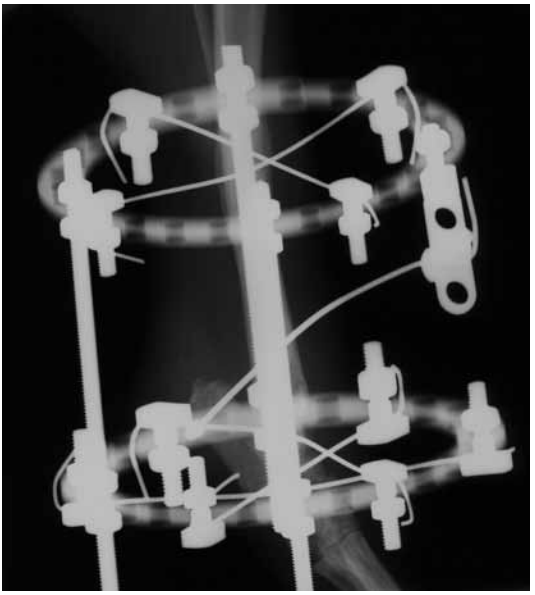
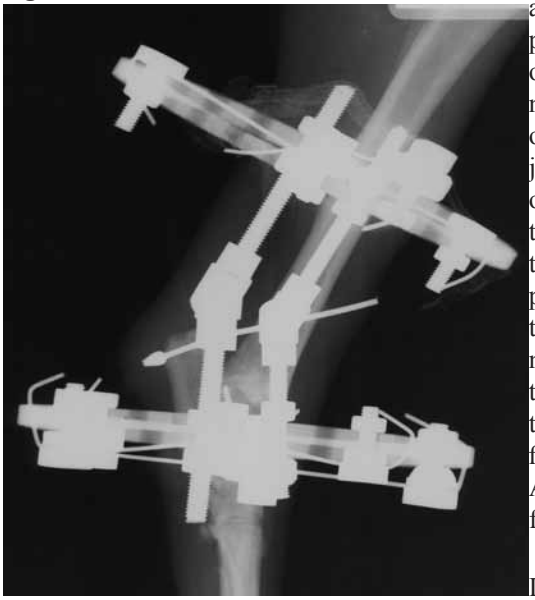


Figure 2



Reckitt and Coleman) were administered postoperatively for 7 and 2 days respectively. Cephalexin (Ceporex: Pfizer) was continued postoperatively for 5 days. The ring was covered by a self adhesive bandage and swabs to avoid snagging or self injury by the bent pins, and was changed every 5-7 days. During the whole postoperative period the dogs were kept restricted to an area of 2-4 m2 with leash walking to the toilet twice daily. Clinical examination was performed every 4 weeks during the period that the fixator was in place, and also included checking for nut loosening.

RESULTS

The signalements were as follows: dog 1 was a 3 year old male (n) Boxer 32Kg; dog 2 was a 9 year old female(n) Labrador 39Kg; dog 3 was a 8 year old female (n) Labrador 34kg; dog 4 was a 3 year old male (n) Doberman 41Kg (Table 1). The time from first diagnosis to circular fixator surgery was as follows, dog 1 four months; dog 2 three months; dog 3 eight months; dog 4 four months. Dog 1 had a contra lateral cruciate rupture at the same time as the CCT injury which was treated using tibial plateau levelling osteotomy. Dog 2 had a bilateral injury. Dog 3 had been operated on twice before by the referring veterinary surgeon with postoperative stabilisation using a half cast first and a modified transarticular external fixator the second time. Dog 4 was a particularly hyperactive and difficult dog to control so only conservative methods had been attempted previously.

Complications in the postoperative period were mostly minor such as pin site discharge associated with pin loosening. This occurred in the final stages, especially in dogs 2 and 4. However these did not present a clinical problem. In dog 2 the hinges rotated at one stage preventing movement but this was quickly rectified. There was nut loosening in dogs 1 and 2 was at the hinge and this was solved by changing to nylon insert nuts as instead of plain nuts. After pin removal in dog 3 a temporary mild proprioceptive deficit in the operated limb was clinically evident which lasted 4 weeks. Limb function while the fixator was in place was good with virtually normal weight bearing, except in the final stages as a result of pin loosening. The final follow up clinical examination was performed between 8 months and 1 year, with a mean of 10 months. In terms of eventual outcome all dogs were classified as having a normal gait. The hock was considered to be at the normal joint angle in all dogs except dog 3 which had a mildly greater flexed hock than considered normal.

DISCUSSION

The accepted protocol for treatment of rupture of the CCT in small animals and Achilles tendon in humans is reconstruc-

Table 1 *Signalement and case details*

Case and Breed	Age yrs	Sex	Kgs	Rupture Type	Other injuries	Complications	Outcome
1. Boxer	3	M	32	Complete CCT	Cruciate rupture	Pin loosenng	Normal
2. Lab	9	F	39	Gastroc-Bilateral	None	Pin lossening	Normal
3. Lab	8	F	34	Gastroc	None	Pin loosening nerve deficits	Hock flexed
4. Dob	4	M	41	Gastroc	None	Pin loosening	Normal

Key
Lab- Labrador retriever
Dob- Dobermann pinscher
CCT- Common Calcanean tendon
Gastroc- Gastrocnemius rupture only

tion with a period of rigid immobilisation followed by progressive controlled use of the limb. In human orthopaedics the trend is now towards surgery, as surgery and early motion produce superior results to conservative treatment[8], and decrease the incidence of rerupture[9]. A meta-analysis published by Suchak in 2006 looking at rehabilitation following Achilles tendon repair found a better subjective outcome with no increase in rerupture rate in the early functional treatment group compared to plaster immobilisation for six weeks. There are no reports in the literature of successful conservative only treatments for CCT rupture in dogs as far as the authors are aware. The controlled weight bearing during the rehabilitation period must be appropriate considering that the strength of the repaired CCT would never approximate to the original strength at 6 weeks.

In humans with Achilles tendon rupture, early mobilisation after 2 weeks casting showed no difference in outcome isometric strength or tendon thickness when compared with 8 weeks casting[6], and early motion produced less postoperative tendon elongation than casting[10]. Early mobilisation in human Achilles tendon repair compared to casting does not lead to a higher incidence of rerupture[11]. The accepted postoperative protocol by human surgeons for acute and chronic Achilles tendon rupture[12] is below the knee cast for 2 weeks with immediate weight bearing, cast removal at 2 weeks and anterior splint which allows full plantar flexion for 6 weeks with resistance exercises starting at 2 weeks post operatively, and then a gradual return to normal activity after anterior splint removal at 8 weeks post operation. In small animals the postoperative management can be summarised from the literature as, cranial half cast for 6-8weeks and then bandaging for 2 weeks[1], cranial splint for 2 weeks and bandaging for 2 weeks (3 month old dog) 3, transarticular external fixator for 4 weeks followed by 2 weeks of coaptation[2], 2 weeks full cast, 10 weeks orthosis, intermittent orthosis for 5 months during activity (bilateral case)[5] and immobilisation of 10 weeks using screw/cast, variable cast formations, external fixator[4]. The average of these (excluding Shani and Sharar[3] as this was a puppy, and Swiderski et al[5] as this was bilateral) gives a protocol of 8.5 weeks immobilisation followed by 1-2 weeks of bandaging. The four cases in this report had 4 weeks immobilisation followed by 2 weeks decreased immobilisation followed by 2 weeks full hinged mobilisation followed by bandaging for 2 weeks. Comparing the cases in this report and the data from the human literature to the current veterinary literature raises the issue that the recommended period for immobilisation of the tarsocrural joint following CCT repair is not known.

The complications encountered in the 4 cases were mainly based on loosening and subsequent drainage around the tensioned wires. However there were no significant clinical problems with this finding. In dog 3 there was a proprioceptive deficit noted after circular fixator construct removal and the authors are of the opinion that some nerve damage may have occurred at the time of insertion or possibly removal, but the deficit was temporary. A review of the literature reveals that postoperative complications such as implant loosening or failure of the immobilisation method would average at 25-60%, but failure of the tenorraphy at approximately only 7%[2,4]. Casting or coaptation results in a cast failure rate of 40% and a failure of the tenorraphy of 20%[1]. However these figures are based on a very small case numbers and if one compares the human literature to the veterinary literature there is an obvious lack of randomized trials and Meta analysis in the veterinary journals. This may well reflect the fact that human Achilles tendon rupture is relatively common compared to dogs and thus there are an insufficient number of dogs with CCT rupture reported in peer review publications to enable dependable analysis.

The limitation in this case report is the small number of dogs. The results, however, are encouraging because in the management of these four complex cases each dog seemed to benefit from more controlled

transition from rigid to flexible immobilisation. Therefore, on this basis the technique warrants further investigation.

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