

Surgical Repair of Bilateral Atrophy of the Quadriceps Muscles in a Calf

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History

A 25 day-old Holstein heifer was presented at the University of Illinois Veterinary Medicine Teaching Hospital unable to support weight on the rear limbs. The calf had been housed in a calf hutch and had been found a week earlier hanging over a fence with both rear limbs caught in the fence. The calf was found in the morning so it may have been entangled in the fence for as long as 12-14 hours.

Clinical Examination

The body temperature was 39.6°, the heart rate 120 beats/min and the respiratory rate was 36 breaths/min. The calf could stand on the forelimbs but was unable to get beyond a squatting position in the rear limbs. (Fig.1) There was insufficient muscle strength to extend the stifle and hocks and the tuber calcis of both limbs were almost in contact with the ground. Palpation of the rear limbs revealed severe atrophy of the tensor fasciae latae (TFL) and the quadriceps femoris (QF) muscles

Figure 1. Twenty-five day old calf with bilateral atrophy of the tensor fasciae latae and quadriceps femoris muscles.



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especially the rectus femoris (RF) muscle in both legs. Several small fibrotic masses were palpable in these muscles. The insertions of the QF muscles on to the patella were torn. Although still attached, a separation about 2 cm in length could be palpated between the muscle bellies and the patella.

Radiographs of the pelvis were normal. Electromyography of the quadriceps femoris, gastrocnemius and anterior tibial muscles indicated good muscle function in both limbs.

Surgery

Surgery was done on the left leg 4 days after admission. Anesthesia was maintained with halothane and oxygen after tracheal intubation. The calf was placed in right lateral recumbency. A 30 cm skin incision was made cranio-laterally between the tuber coxae and stifle. The TFL muscle was pale and atrophied. The fascia of the TFL muscle was incised longitudinally to expose the RF muscle. The RF muscle was pale and small, being almost band-like. The tendinous insertion of the RF muscle on to the patella was stretched and partially disrupted. The other muscles of the QF muscle group appeared to be complete and attached to the patella, although pale with some atrophy. The RF muscle belly was elongated, allowing marked extension of the hip and provided little or no support of the lower limb. The RF muscle belly was transected near its distal end and a 4 cm section was removed. The muscle belly ends were apposed and 7 horizontal mattress sutures of 0 Dexon (Davis & Geck) were pre-placed through the proximal muscle belly and through the distal muscle belly and the fibrous attachment to the patella. The sutures were tied while the lower limb was held in extension. The apposed muscle edges were sutured with simple interrupted sutures of 0 Dexon. Three horizontal mattress sutures of carbon fibers (120000 fibers/strand) (Hercules, Inc., Magna, UT) about 15 cm in length, were placed in the RF muscle and reattached the RF muscle to the tendinous insertion on the patella. These sutures

were tied with the lower limb extended. Subcutaneous tissues and skin were sutured in a routine manner.

Following surgery, the calf made attempts to stand but could not support weight on the rear limbs. The calf was placed in a sling daily for 20 minutes. Physical therapy was done several times daily for 5 minute periods. The limbs could be moved through a full range of motion. Phenylbutazone (10 mg/lb) was given orally every other day.

Surgery was done on the right leg 13 days after the previous surgery using the same surgical procedure. The TFL muscle was pale and atrophied. The RF muscle was pale, atrophied and lengthened as well as being partially detached from the tendinous insertion onto the patella.

On the day following the second surgery, the calf stood and walked about 4 feet although the stifles were flexed. The calf remained in the hospital for 14 more days. While in the hospital the calf was placed in a sling for 20 min daily and physical therapy continued. The calf would stand for 1-2 min when disturbed.

The owner continued to place the calf in a sling twice daily. He reported a marked improvement in the calf's condition about 30 days after discharge from the hospital. The calf was able to stand and support weight on the rear limbs. Over the next 3 weeks the calf improved and was able to stand and walk almost normally except the back was slightly arched. (Fig. 2) The heifer functioned normally in the rear limbs. At breeding age the heifer showed an aggressive disposition and was removed from the herd because of it.

Figure 2. The calf at 9 weeks following surgery.



Discussion

The partial detachment of the RF muscles from

the patella removed the load on the muscle and disuse atrophy developed in about a week. This rapid atrophy is similar to the neurogenic atrophy of the QF muscles in calves suffering femoral nerve injury during birth.¹ Paulsen, *et al.*² severed the femoral nerves in calves and reported that QF atrophy was apparent by 10 days. The RF and TFL muscles flex the hip joint as well as extend the stifle joint, while the other QF muscles join to extend the stifle.³ The RF muscle bellies were undoubtedly stretched and with the partial detachment of the insertion of the patella, flexion of the hip joint was not possible. Shortening the RF muscles initially prevented over-extension of the hip joint and muscle function returned with physical therapy and sling support of the calf. Although it was not possible to re-examine the calf, it would appear that muscle function returned about 6-8 weeks post-surgery.

Carbon fiber implants were used to reinforce the tendinous insertion to the RF muscle to the patella. Carbon fiber strands provide mechanical support initially and then this function is ultimately replaced with fibrous tissue that is laid down along the fibers by fibroblasts.^{4,5,6} Transection and reattachment of the insertion did not seem feasible because of inability to provide long term immobilization of the rear limbs and great tension would be placed on the sutures if the animal commenced to crawl about. This support of the RF muscles seemed sufficient since the calf attempted to stand after the first surgery and was able to stand, although very briefly on the day following the second surgery.

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