



CASE REPORT

Partial Tibial Neurectomy for Treatment of Spastic Paresis in a Simmental Calf

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Simmental Buzağında Spastik Parazinin Tibial Nörektomi ile Sağaltımı

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Öz

Spastik parazi, genellikle 3-5 aylık buzağlarda ortaya çıkan ilerleyici nöromusküler bir hastalıktır. Bu çalışma materyalini, Mayıs 2023'te Selçuk Üniversitesi Veteriner Fakültesi Büyük Hayvan Hastanesi'ne sağ arka bacağına topallık şikayeti ile getirilen 87 kg ağırlığındaki, 3,5 aylık bir dişi Simmental ırkı bir buzağı oluşturdu. Klinik muayenede, buzağının sağ arka bacağına kontraksiyon ve hiperextensiyon belirlendi. Tarsal ve genu ekleminde ve diğer anatomik bölgelerde şişkinlik veya ağrı tespit edilmedi. Radyolojik muayenede dejeneratif eklem hastalığı bulgularına rastlanmadı. Yapılan klinik muayene sonuçlarına göre progresif spastik parazi tanısı konuldu. Hastalığın tedavisi için n. tibialisin parsiyel nörektomisi yöntemine başvuruldu. Bölgeye yaklaşmak için semimembranöz ve gluteobiceps kasları üzerine 15 cm'lik ensizyon yapıldı. Ardından gastrocnemius kaslarını innerve eden tibial sinir belirlendi ve 1 cm'lik bir kısmı rezeke edildi. Böylece ekstremitenin gastrocnemius kaslarının deinervasyonu sağlandı ve ağırlık m. fleksör digitorum superfisialis'e aktarıldı. Ameliyat sonrasında, hastaya antibiyotik ve ağrı kesici tedavisi uygulandı. Sonuç olarak; spastik parazi olgusunda kas spazmları ile ilgili ağrı ve kasılmalar parsiyel tibial neurektomi operasyonunun ardından ortadan kalkmış ve buzağının yaşam refahı artmıştır.

Anahtar kelimeler: Buzağı, spastik parazi, parsiyel nörektomi

Abstract

Spastic paresis is a progressive neuromuscular disease that usually occurs in calves at the age of 3-5 months. The material of this study was a 3.5-month-old female Simmental calf, weighing 87 kg, brought to Selçuk University Faculty of Veterinary Medicine Large Animal Hospital in May 2023 with a complaint of lameness in the right hind leg. Clinical examination revealed contraction and hyperextension in the right hind limb of the calf. There was no swelling or pain in the tarsal or genu joints or other anatomical regions. Radiological examination showed no evidence of degenerative joint disease. A diagnosis of progressive spastic paresis was made on the basis of the clinical findings. Partial neurectomy of the tibial nerve was made to treat the calf with spastic paresis. A 15 cm incision was made over the semimembranous and gluteobiceps muscles to access the area. The tibial nerve innervating the gastrocnemius muscles was then identified and a 1 cm section was resected. This de-innervated the gastrocnemius muscles of the limb and the weight was transferred to the flexor digitorum superfisialis. Postoperatively, the patient was treated with antibiotics and analgesics. In conclusion; in the case of spastic paralysis, pain and contractions related to muscle spasms disappeared after the partial tibial neurectomy operation and the life welfare of the calf increased.

Keywords: Calf, spastic paresis, partial neurectomy



Introduction

Spastic paresis in cattle "flat knee or Elso" is a progressive neuromuscular disease characterized by spastic contraction of the gastrocnemius and/or quadriceps femoris muscles unilaterally or bilaterally and excessive hyperextension of the genu and tarsal joints (Baker et al 1989, Arıcan 2017). Spastic paresis was defined as a neurological disease when first observed, but histological examination did not reveal any central or peripheral nerve, muscle or tendon lesions, and was declared hereditary and a primary functional abnormality of recessive genes (Ducharme 2004). The disease is common in cattle and rare in goats (Baker et al 1989). The more common early form of the disease occurs in calves aged 3-8 months and the late form occurs in cattle aged 2-6 years (Weaver et al 2005, Goeckmann et al 2016).

Clinical signs of the disease are never seen in recumbent calves. Therefore, careful observation of the hind limbs and palpation of the spastic muscles while the calf is standing and moving is very important in diagnosing the disease (De Vlamynck et al 2014). Symptoms are unilateral at first. Then there is often stiffness in both hind legs and increased stiffness when the balls of the heels are lifted off the ground (Weaver et al 2005). Clinical examination reveals incoordination in the gait of the calves, treading on the ground with the tip of the hoof, straining to move the affected limb forward during walking, attempting to walk on three limbs and placing the affected limb caudal to the normal hind limb during stance. The leg can be easily and painlessly flexed by hand, but immediately returns to the overextended position when released (Weaver et al 2005). Degenerative changes in the joint can be seen on x-ray images parallel to the disease duration. In older cattle, hyperextension of the tarsal joint in excess of 180° is seen. Atrophy of the extremity muscles and decubitus wounds occur (Harper 1993, Ducharme 2004, Weaver et al 2005). The prognosis is poor if the disease is not treated. In order to ensure that patients grow to slaughter weight, treatment can only be carried out using surgical methods. The preferred techniques are total neurectomy, partial tibial neurectomy, triple tenotomy and triple tenectomy (Ducharme 2004, Weaver et al 2005).

A major welfare concern is the physical condition of animals with spastic paresis and the constant pain and stress caused by muscle spasms. Therefore, this case report evaluates the treatment and results of partial tibial neurectomy in a Simmental calf with unilateral spastic paresis to reduce muscle spasticity, enable it to stand and walk normally and grow to slaughter weight.

Case presentation

Case

The study material consisted of a 3.5-month-old female

Simmental calf, weighing 87 kg and 3.5 months old, which was brought to the Selcuk University Faculty of Veterinary Medicine Large Animal Hospital on 26 May 2023 with a complaint of contraction in the right hind limb with inability of full use of the foot while walking.

Anamnesis

It was noted that the mother was naturally mating, the birth was normal, the calf looked quite healthy after birth, there were no abnormalities in its movements and it sucked the mother easily (Figure 1). The first clinical signs in this case were observed in the calf at the age of 2.5 months, with complaints that the right hind limb of the calf had tremors while suckling its mother, stepped on the ground with its hoof tip, moved the affected limb forward in a tense manner while walking, along with atrophy of the limb muscles.

Clinical Findings

On examination, it was observed that the right leg was seemed to be longer due to like a stick appearance of the right leg and overextension in the tibia tarsal joint compared to the contralateral part. Stiffness and contraction of the gastrocnemius muscle was noted on palpation of the affected limb.

There was no swelling, no pain and no accumulation of synovial fluid in the tarsal joint, the genu joint and other anatomical regions of the right hind limb. Radiographic examination of the limb revealed no degenerative disease of the tarsal and genu joint. According to the results of the examination, the patient was diagnosed with an early form of progressive spastic paresis and a partial neurectomy of the tibial nerve was recommended. Before the operation, hemogram and biochemical analyses, body temperature, heart rate and respiratory rate were measured and found to be within physiological limits.

Surgical procedure

The patient was fasted for one day prior to surgery. The surgical area was shaved and disinfected. A 22-gauge catheter was inserted into the right auricular vein of the calf. Xylazine (Xylazinbio 2%, Bioveta, Interhas, Ankara) was injected intramuscularly at a dose of 0.1 mg/kg for sedation (McFarlan et al 2023). To achieve complete paralysis of the hind limbs, the calf was placed in the sternal recumbency and caudal epidural anaesthesia was performed with 2% lidocaine HCL at a dose of 0.4 mL/kg (Adocain, Sanovel, Arion İlaç San. Tic. A.Ş. İstanbul) (Meyer et al 2010). The calf was fixed on the operating table in a lateral recumbency with the right hind limb placed superiorly. Lactated Ringer's solution (Polifleks Lactated Ringer's I.V. Polifarma, Tekirdağ) was given as an infusion during the surgery. Rutin asepsis of the surgical area was carried out and the area restricted with surgical drape. For partial tibial neurectomy, a skin incision of approximately 15 cm was made over the junction of the



Figure 1. Healthy image of a calf after birth.

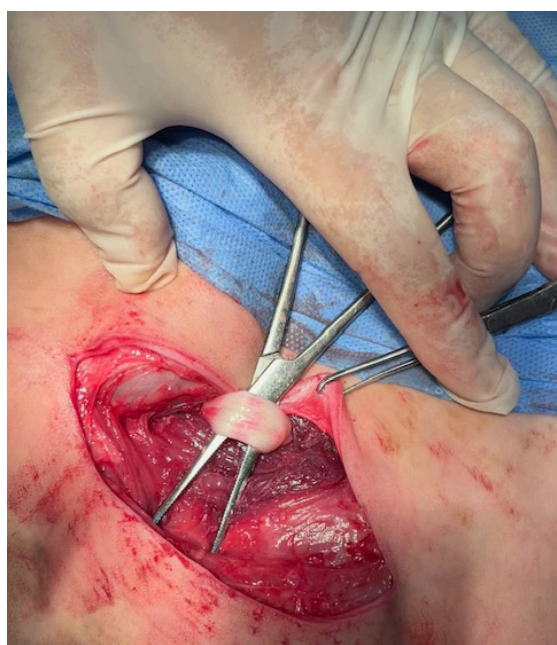


Figure 2. Identification branches of the tibial nerves innervating the gastrocnemius muscles.

semimembranosus and gluteobiceps muscles. The incision was extended along the fascia. After lateral dissection of the semimembranosus and biceps femoris muscles, the branches of the tibial nerves innervating the gastrocnemius muscles were identified. The peroneal nerve was identified lateral to the gastrocnemius muscle. It was left untouched in order to identify the correct nerve branches for neurectomy. Then, the branches of the *n. tibialis* extending lateral and medial to the gastrocnemius muscle were identified in the middle of the lateral and medial gastrocnemius muscles. A 1 cm section of the nerve branch from the tibialis nerve to these muscles was resected (Figure 2). The nerve was ligated proximally with non-absorbable sutures to prevent axonal regeneration. The muscle, subcutaneous connective tissue was closed with absorbable 1 PGA (Alcasorb Katsan, Türkiye) and the skin was closed with simple separate

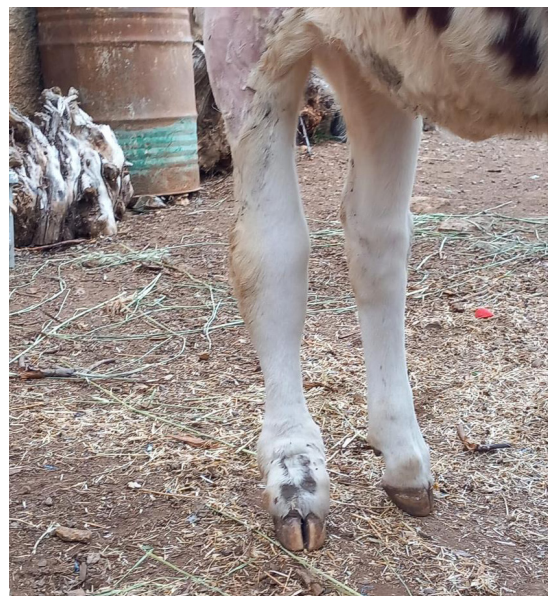


Figure 3. Postoperative image showing disappearance of spastic contractions and hyperextension in the right hind limb and normal gait.

sutures using USP 2 PGA suture material (Alcasorb Katsan, Türkiye). Post-operatively, the calf was discharged with the recommendation that it be placed in a paddock with a non-slip floor and given 2.2 mg/kg ceftiofur IM (Ceftisin, Teknovet İlaç San. Tic. A.Ş. İstanbul) for 5 days and meloxicam (Bavet Meloxicam, İstanbul) 0.5 mg/kg SC for 2 days, and to return to the clinic on post-operative day 10 for inspection and removal of the skin sutures (McFarland et al 2023).

Postoperative findings: The patient was hospitalized for 10 days postoperatively. Spastic contractions and hindlimb hyperextension disappeared two days postoperatively, but mild lameness remained. One week later, the patient's stance, stride and gait returned to normal (Figure 3). The patient's owner was contacted by telephone 1 month after surgery and informed that the hind limb function was normal.

Results and Discussion

Although spastic paresis of the calf is known to be a progressive neuromuscular disease, there is no consensus on its aetiopathogenesis, prevalence, race and sex (De Vlamynck et al 2013). The disease is inherited, but whether it is caused by dominant or recessive genes has not been clearly understood, and more than one recessive gene has been suggested. It has been reported that spastic paresis can occur unilaterally or bilaterally in both dairy and beef breeds, and more frequently in Belgian Blue breeds (Vlaminck et al 2000, Ducharme 2004). Griffiths reported that the prevalence of spastic paresis was higher in female calves (Griffiths 2005), whereas Ledoux reported that the disease was more common in male calves (Ledoux 2001).

In the present case, the history, clinical findings and results of partial tibial neurectomy for unilateral spastic paresis in a female Simmental beef and dairy calf were evaluated. Although the first clinical signs in calves appear two or three weeks after birth, characteristic clinical signs are usually seen in 3-5-month-old calves (Vlaminck et al 2000). Due to the progressive nature of the disease, the calf spent more time lying down, the limb muscles atrophied and remained weaker than the growth rates of its peers (Vlaminck et al 2000, Touati et al 2003).

Spastic paresis was primarily defined as a condition that caused excessive extension of the limb due to spastic contractions of the gastrocnemius muscles (Goeckmann et al 2016). However, Touati et al (2003) reported that the disease also affected the quadriceps muscle group in cases of spastic paresis in Belgian Blue calves. Thus, spastic paresis began to be defined as a form of the disease that affected only the gastrocnemius or the quadriceps, or both muscle groups. The diagnosis is based on clinical findings such as posterior hyperextension of the limb with recurrent spastic contractions when the gastrocnemius muscles are involved, anterior hyperextension of the limb with spastic contractions when the quadriceps muscles are involved, and excessive contraction on palpation of the muscles. For a definitive diagnosis of the disease, it is possible to determine which muscle group is affected by blocking the n. femoralis under ultrasound guidance (De Vlaminck et al 2013). Epidural injection of procaine solution causes clinical symptoms to disappear after 10-15 minutes when the gastrocnemius muscle is involved (De Ley and De Moor 1979), however it does not cause a change in clinical symptoms when the quadriceps or both muscle groups are involved (Vertenten 2006). Researchers state that surgical treatment of the disease is successful in cases where the gastrocnemius muscle group is affected, but the success rate is low in other forms (De Vlaminck et al 2013). In the present case, the diagnosis of an early form of spastic paresis affecting the gastrocnemius muscle group was made on the basis of the findings obtained from the patient's general observation, gait and palpation of the right hind limb. The absence of osteoporotic areas and exostoses (Frederik and Van 't Hooft 1962) in the radiographs of the genu and tarsal joints in cases of advanced disease may be related to the early diagnosis of the case and the young age of the patient. As spastic paresis causes neuropathic pain, it is a serious welfare issue for the animals that are affected by this disease (Vlaminck et al 2000). Therefore, surgical treatment is recommended to improve the quality of life of animals affected by spastic paresis until they reach slaughter weight (Goeckmann et al 2016). Conservative treatment of the disease has not been successful (Arnault 1982). The recommended surgical methods for treatment of spastic paresis are a 2 cm to 3 cm tenectomy of the superficial and deep tendons of the gastrocnemius muscle and resection of the motor branches

of the tibialis nerve. Although resection of the superficial and deep tendon of the gastrocnemius muscle can be performed under field conditions (McFarland et al 2023), partial neurectomy of the *n. tibialis* is another surgical method that can be performed by experienced surgeons. During neurectomy, the surgeon's anatomical knowledge plays an important role in distinguishing the nerve branches in the region. Another difficulty with neurectomy is that the nerves run deep through the muscle layers, which makes it difficult to reach the area and therefore the operation takes longer (De Vlaminck et al 2013). Partial tibialis neurectomy was performed to treat the calf diagnosed with spastic paresis. According to the purpose of the operation, the gastrocnemius muscle of the limb was deinnervated and the load was transferred to the flexor digitorum superficialis. There were no postoperative clinical complications. The patient's standing posture, standing on the ground and gait returned to normal after surgery, which is consistent with the findings of the Vlaminck et al study (2000). Under field conditions, tenectomy of the gastrocnemius muscle group may offer advantages such as easier access to the surgical site, greater economy and shorter operative time (McFarland et al 2023). However, the fact that the results of tenectomy studies are limited to case reports and therefore, may be considered insufficient to determine the superiority of the technique.

The partial tibial neurectomy carried out in the case of spastic paralysis described here was successful, leading to a significant improvement in the animal's well-being. Post-operation, there was a notable reduction in pain and contractions associated with muscle spasms related to spastic paresis, contributing to an enhanced overall sense of well-being for the animal.

Performing a neurotomy in the field can present challenges, including difficulties in identifying the precise incision site, accessing the targeted area, and accurately identifying and resecting nerve branches. Consequently, to establish the effectiveness of treatment methods for spastic paresis, it is essential to conduct experimental and controlled clinical trials.

Conflict of Interest

The authors declare no conflict of interest or financial support.

References

- Arıcan M, 2017. İskelet Sistemi Cerrahi Yaklaşımları. Sığır Cerrahi Atlası. I baskı, Damla Ofset A. Ş., Karatay, Konya, 298-299.
- Arnault GA, 1982. Bovine spastic paresis. An epidemiologic,



- clinical and therapeutic study in a Charolese practice in France. Efficacy of Lithium therapy. In Proceedings of the XIIth World Congress on Diseases of Cattle, September 7-10, 1982, Internationaal Congressentrum RAI, Amsterdam, the Netherlands/World Association for Buiatrics.: Dutch Section of the World Association for Buiatrics, 1982. Utrecht, Netherlands.
- Baker J, Ciszewski D, Lowrie C, Mullaney T, 1989. Spastic paresis in pygmy goats. *J Vet Intern Med*, 3, 113.
- De Ley G, De Moor A, 1979. Bovine spastic paralysis: Results of selective afferent suppression with dilute procaine. *Vet Res Commun*, 3, 289-298.
- De Vlamynck C, Vlaminc L, Hauspie S, Saunders J, et al., 2013. Ultrasound-guided femoral nerve block as a diagnostic aid in demonstrating quadriceps involvement in bovine spastic paresis. *Vet J Vet J*, 196(3), 451-455. <https://doi.org/10.1016/j.tvjl.2012.10.033>
- Ducharme NG, 2004. Chapter 15 Surgery of the Calf Musculoskeletal System, In: *Farm Animal Surgery*, Ed: Fathman EM, Merchant T, Elsevier, USA, p.349-350. <https://doi.org/10.1016/B978-0-323-31665-1.00018-6>
- Frederik GH, Van't Hooft AJG 1962. Spastic paresis in cattle of the Meuse-Rhine-Yssel breed and some X-ray studies. *Tijdschr Diergeneeskd*, 87, 699-707.
- Goeckmann V, Rothammer S, Medugorac I, 2016. Bovine spastic paresis: A review of the genetic background and perspectives for the future. *Vet J*, 216, 64-71. <https://doi.org/10.1016/j.tvjl.2016.07.001>
- Griffiths IB, 2005. Spastic paresis in calves. *The Veterinary Record*, 156(24), 786. <https://doi.org/10.1136/vr.156.24.786-e>
- Harper PA, 1993. Spastic paresis in Brahman crossbred cattle. *Aust Vet J*, 70(12), 456-457. <https://doi.org/10.1111/j.1751-0813.1993.tb00852.x>
- McFarland DS, Woods TS, Macrae AI, Kelly RF, 2023. A modified tenectomy approach to a case of spastic paresis in a 10-month-old bullock. *Vet Rec Case Rep*, e681. <https://doi.org/10.1002/vrc2.681>
- Meyer H, Kästner SB, Beyerbach M, Rehage J, 2010. Cardiopulmonary effects of dorsal recumbency and high-volume caudal epidural anaesthesia with lidocaine or xylazine in calves. *Vet J Vet J*, 186(3), 316-322. <https://doi.org/10.1016/j.tvjl.2009.08.020>
- Ledoux M, 2001. Bovine spastic paresis: etiological hypotheses. *Med hypotheses*, 57(5), 573-579. <https://doi.org/10.1054/mehy.2001.1411>
- Touati K, Muller PH, Grulke S, Peters F, et al., 2003. La parésie spastique du quadriceps fémoral: Une nouvelle entité clinique chez le veau de race Blanc Bleu Belge. *Ann Med Vet*, 147, 261-265.
- Vertenten G, 2006. Recente evolutie van spastische parese bij het kalf. *Het Dierenartsen Weekblad*, 44, 14-17.
- Vlaminck L, De Moor A, Martens A, Steenhaut M, et al., 2000. Partial tibial neurectomy in 113 Belgian blue calves with spastic paresis. *Vet Rec*, 147(1), 16-19. <https://doi.org/10.1136/vr.147.1.16>
- Weaver AD, Jean GS, Steiner A, 2005. Lameness, In: *Bovine Surgery And Lameness*, Ed: Weaver AD, Jean GS, Steiner A, 2nd edition, Blackwell Publishing Ltd, UK, p.246-248.

Author Contributions

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Ethical Approval

Selçuk University Experimental Research and Application Center, 28.12.2023, 2023/14 Number Ethics Committee Decision.

