Radiographic Changes of Bilateral Partial Avulsion Fracture of Tibial Tuberosity in a Dog

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Abstract: A 4-month-old intact male Jindo dog was presented for left hindlimb lameness. On radiographs, a small mineralized piece was identified beneath the apophysis of tibia with no or minimal displacement of apophysis bilaterally. Subsequently, the cranioproximal bony aspect of the tibia changed radiolucent to radiopaque. The left side recovered after surgical management, but the right side was self-limited with conservative management. The diagnosis was partial avulsion fracture of the tibial tuberosity which has been called 'Osgood-Schlatter disease' in dogs.

Key words: dog, partial avulsion fracture, tibial tuberosity, Osgood-Schlatter disease.

Introduction

The tibial tuberosity is an apophysis on the craniodistal aspect of the tibia (5,17). It is the site of insertion of the quadriceps femoris muscles along with parts of the biceps femoris and sartorius muscles (5,17). There are two physes associated with the tibial tuberosity, at the cranial aspect of the proximal tibial epiphysis and at the craniodistal aspect of the tibial diaphysis (17). Fractures through the physis result in proximal displacement of the tuberosity are called avulsion fracture of tibial tuberosity (10). In dogs, a new classification of avulsion fracture of tibial tuberosity based on radiographic features was suggested recently (20). According to the classification, Osgood-Schlatter disease in dogs is relevant to a partial avulsion fracture of tibial tuberosity (20). This case report describes the serial radiographic changes of bilateral partial avulsion fracture of tibial tuberosity in a dog.

Case

A 4-month-old, intact male, Jindo dog was presented with acute-onset of diarrhea. He was hospitalized for monitoring small sized radiopaque materials in gastrointestinal tract found on radiographs. On the first day of hospitalization, he showed left hindlimb lameness with pain after jumping in the cage. There was an intermittent reluctance to weight bearing of left hindlimb. On physical examination, swelling of the soft tissue surrounding the left proximal tibia was not extensive. The right hindlimb was normal.

On radiographic examination, craniocaudal and mediolateral projections of both hindlimbs were obtained. A small mineralized piece beneath the apophysis of tibia with mild effusion of the left stifle joint was found on mediolateral radiograph. The right hindlimb was not remarkable (Fig 1).

Avulsion fracture of the left tibial tuberosity was tentatively diagnosed according to the clinical signs and initial radiographic examination. Radiographs were taken ten days after applying conservative management on the left hindlimb. The small mineralized piece beneath the apophysis of left tibia became smaller and faint, but cranioproximal aspect

Fig 1. Mediolateral radiographs of stifle joint at the initial clinical signs. In A, a small-sized bony particle (arrow) found beneath the apophysis of left tibia and the synovial mass was mildly increased (asterisk) consistent with mild effusion of left stifle joint, and there was no or minimal displacement of apophysis. The right stifle joint appeared not remarkable (B).
The avulsion fracture of tibial tuberosity is a relatively rare occurrence and may involve extrinsic or intrinsic factors (17). Generally, it must be reduced and stabilized to restore quadriceps muscles function and stifle extension (10).

The diagnosis of avulsion fractures in stifle joint includes confirming displacement of the tibial tuberosity on radiographs (1). In this case, there was no or minimal displacement of tibial tuberosity. Whereas, the small mineralized piece beneath the apophysis was appeared on proximal tibia radiographs, following radiolucent and radiopaque changes of the cranioproximal aspect of the tibia on serial radiographs. Specific radiographic changes of tibial tuberosity in immature dogs, like this case, have been generally called ‘Osgood-Schlatter disease’ in dogs. Osgood-Schlatter disease of the tibia became radiolucent (Fig 2). Although there was no or minimal displacement of apophysis, it was evaluated that the instability of tibial tuberosity was increased. After surgical management applying tension bend wire on the left tibia, radiopaque change found in the left tibia within a week. And radiolucent change at identical region on radiograph was found on the other side. Although it had limitation to evaluate the presence or severity of lameness because he had been confined in the cage, he didn’t show any abnormality of right hindlimb including pain or swelling. Differently to other side, no surgical treatment but conservative management was applied to right hindlimb. Serial radiographic recheck was performed. On the 4 weeks, the cranioproximal aspect of the left tibia became more radiopaque and sclerotic. The right side appeared both radiolucent and radiopaque bony changes with widening of the range (Fig 3).

On the 6 weeks, recheck radiographs showed bilateral radiopaque changes of the cranioproximal aspect of the tibia. The pin inserted from apophysis to metaphysis of left tibia was dislocated more cranially with increased soft tissue swelling around the tip of pin. On the 8 weeks, both side of the cranioproximal aspect of the tibia started to show homogenous bone density and smooth bone margin. The tension band wire was removed and the clinical signs disappeared. On the serial radiographs, both side of tibial tuberosity became more radiopaque and remodeled, eventually showed homogenous bone density with smooth bone margin. At 18 weeks after initial clinical signs and radiologic change of left hindlimb, both side of proximal tibia showed almost normal radiographic findings coinciding with that of similar aged dog (Fig 4). The treatment and management was tentatively finished.

**Discussion**

The avulsion fracture of tibial tuberosity is a relatively rare occurrence and may involve extrinsic or intrinsic factors (17). Generally, it must be reduced and stabilized to restore quadriceps muscles function and stifle extension (10).
OSD named after surgeons who first described it (14,15). OSD is a condition affecting human adolescents who exercise and grow rapidly in which there is partial separation of bone fragments from the tibial tuberosity at the site of insertion of the patellar ligament by traction of the muscle-tendon unit at tibial tuberosity (20,21). Radiograph shows swelling around the patellar tendon and stifle joint first, followed by ossified particles within the anterior patellar tendon (7,11,13,22). In veterinary medicine, the term of OSD was first mentioned by Schnelle in 1950 (3) and he reported that the changes of upper tibial region in dogs can occur regarded as strong resemblance to those of OSD lesion in man (2,3,16). But it has been controversial about the use of the term OSD in dogs (2,3,20). Ehrenborg and colleagues compared radiographic features of avulsion of the tibial tuberosity in dogs and that of OSD in man (2,3). They concluded OSD lesion does not occur in dogs because of the difference in the anatomy of the tibial tuberosity and in the development of the insertion of the ligament (2,3). In a recent report, it was also reported that it seems more appropriate to use the term OSD only for people and proposed new classification of avulsion of the tibial tuberosity in dogs (20). The classification system for avulsion of the tibial tuberosity in immature dogs was suggested. Type 1 shows no or minimal displacement of the tibial tuberosity with increasing width of the apophyseal plate, type 2 consists of fracture of apophysis and type 3 shows marked displacement of the tibial tuberosity (20). According to the new classification, our case is relevant to type 1 avulsion fracture of tibial tuberosity because there was no or minimal displacement of the tibial tuberosity. A small-sized bony piece beneath the apophysis of tibia might be the bony strands which the osseous fusion part of the apophysis and diaphysis was detached from the apophysis along with the diaphysis (3).

The right side showed bony change without traumatic event after initial clinical signs of left hindlimb lameness. Bilateral avulsion fracture of the tibial tuberosity are extremely rare and a few cases have been reported in human and veterinary medicine (4,6,8,9,12,17-19). In this case, continuous mechanical stress of the left hindlimb lameness is considered to cause the weakness of the physis of right tibial tuberosity, leading to avulsion fracture of the tibial tuberosity. There was no pain in right hindlimb despite the radiographic changes appeared. It is thought the pain in the contralateral hindlimb could mask the presence of pain or lameness of the other hindlimb (17). The pattern of radiographic findings with subsequent radiolucent and radiopaque changes of tibial tuberosity seemed to be similar bilaterally and showed normal appearance within 18 weeks. To the best of our knowledge, there are few reports describing serial radiographic changes about partial avulsion fracture of tibial tuberosity in dogs.

The prognosis was good regardless of the management employed in this case and the conservative therapy for minimally displaced avulsion fracture is usually successful (3,20). Although histopathological examination was not performed, it is identified that left tibial tuberosity was stable during surgical exploration. Radiopaque bony changes of cranioproximal aspect of the tibia is thought to be repair process including dystrophic callus formation (3,20).

Conclusion

A partial avulsion fracture of the tibial tuberosity was diagnosed in an immature dog with acute lameness of hindlimb and it showed radiolucent and radiopaque radiographic changes in cranioproximal aspect of the tibial tuberosity with no or minimal displacement of tibial tuberosity. Serial imaging findings at bilateral tibia could provide helpful information on the treatment process and prognosis with using surgical intervention or conservative management.

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References

개에서 발생한 양측성 경골조면 부분 견열골절의 방사선학적 변화
계서연·최미현·이남순·장재영·이혜경·김현욱·윤정희*1
해마루 동물병원 및 부속 소동물 임상의학연구소, *서울대학교 수의과대학

요 약 : 4개월 된 수컷 강아지에서 좌측 후지 파행이 발생하였다. 방사선 검사에서 양측 경골 견인 골단 아래 작은 골편이 관찰되었으나, 견인 골단의 변위는 없었다. 그 후 양측 경골 조면 부위의 골밀도는 방사선 투과성에서 비투과성으로 변화하였다. 좌측 경골은 수술 후 회복되었으나, 우측 경골은 보존적 치료로 자가 치료되었다. 본 환자는 경골 조면의 부분 견열골절로 진단되었으며, 이는 개에서 'Osgood-Schlatter disease'로 불리어 왔던 질환이다. 이 증례는 환자의 경골조면 부분 견열골절의 순차적인 방사선학적 영상 변화에 대한 유용한 임상적 정보를 제공할 수 있을 것으로 생각한다.

주요어 : 개, 경골조면, 부분 견열골절, Osgood-Schlatter disease