CORRECTION OF THE ANTEBRACHIAL DEFORMITY IN 23 DOGS

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Summary: The aim of this study was to restore the mechanical axis and normal anatomical alignment of limbs affected by antebrachial deformity in 23 dogs. This study was carried out on 23 dogs with antebrachial deformity caused by malunion on radius and ulna fracture, treated with the circular external skeletal fixator(CESF), linear fixator or intramedullary pinning techniques. The radiographies were taken in 2 different positions (Craniocaudal and Mediolateral). The localization of center of rotation and angulation point (CORA) was determined on radiographies. The osteotomy was performed by those CORA points. In 3 dogs linear external skeletal fixator, in 7 dogs intramedullary pinning and in 13 dogs circular external skeletal fixator were used to correction of antebrachial deformities. The intramedullary cases started using their extremities in postoperative between 20-25 days (mean 22 days). The linear external skeletal fixator cases started using their extremities in postoperative between 7-12 days (mean 9 days). The circular external skeletal fixator cases started using their extremities in postoperative between 1-6 days (mean 2 days). The radiographic examinations revealed that antebrachial deformities of extremity were corrected, and the consolidation was completed in postoperative days 32-57 (mean 40 days). In conclusion, using the circular external skeletal fixator for the correction of antebrachial deformities was successful, first weight bearing were earlier. Circular external skeletal fixator was better than linear external skeletal fixator and intramedullary pinning for correction of antebrachial deformities in dogs.

Introduction

Antebrachial deformity in dogs, which occurs in 0.74% of cases, constitutes the most common form of skeletal growth deformity (6).

It occurs as a result of asynchronous, decreased or absent ulnar or radial physeal growth (10, 12, 23, 27, 28, 30, 34, 41).

Secondary causes of antebrachial deformity include trauma, chondrodysplasia genetic predisposition, metabolic diseases, hyperparathyroidism, rickets, multiple cartilaginous exostoses and hypertrophic osteodystrophy (13, 16, 41).

Further to these factors, deformities in dogs occur due to the malunion of antebrachial fractures, contracture of joints and polyarthritis (31).

For the correction of angular deformities, various methods of correction have been used, involving stabilization with plates and external skeletal fixation (10, 12-14, 20, 25, 27, 30, 34, 35, 37, 39, 40).

The aim of this study was to restore the mechanical axis and normal anatomical alignment of limbs affected by antebrachial deformity by either acute or progressive correction with a circular external skeletal fixator (CESF), linear fixator or intramedullary pinning techniques.

Materials and Methods

The study was performed on 23 dogs which were brought to the University Animal Hospital. Each had antebrachial deformity and length deficit of the extremity.

It was necessary to lengthen the affected extremity with distraction osteogenesis following the correction of the angular deformity and therefore, it was decided to utilize a

CESF, linear fixator or intramedullary pinning techniques for the surgical treatment.

Prior to correction of the deformity, detailed pre-operative planning was performed. Measurements of the deformities were taken from the radiographs and included the plane or planes of deformity, Center, Rotation and Angulation (CORA) point and length deficit. Measurements of anterioposterior (AP) deformities were made with mediolateral (ML) plane radiographs whilst AP radiographs were used for ML deformities (1, 4, 5-8, 22, 28, 29, 37). All angles were calculated by Bs200Pro Software (BsCelik, BAB Digital Imaging System 2007, Ankara, Turkey) with computer imaging.

Configuration of the apparatus

To correct the deformity, best practice was applied when building the CESF ring system, and particularly in the functioning of the important hinges (1, 2, 5-7, 15, 20, 37). The longest possible frame was used since the stability increases with increasing frame length. The extremity was carefully placed at the exact midpoint of the ring and the pins tensioned with a force of 70 kg/f by using a dynamometric pin tensor machine.

Post-operative follow-up

Phenylbutozone (44 mg/kg, 3 times a day) was administered intramuscularly for 3 days where applicable. The transsection level and directions of the pins through the osteotomy site were checked by use of two plane radiographs, and no problems were identified. In order to prevent pin track infection, dressings incorporating rifamicine (Rifosin amp., Hoechst 250 mg/3 ml.) and nitrofurasone (Furaderm pom., Toprak 0.2%) were placed against the holes where the pins passed through the skin. The apparatus was protected from the environment with a bandage. As a parenteral antibiotic, Septazidim penhydrate (Fortum amp., Glaxo-Wellcome 1.0 gr) was used for 5 days following the operations. Radiographs from the cases were taken periodically every 15 days. A 10 minute leash-walk (twice a day) was recommended for the cases. The owners were also advised to end the physiotherapy after the case was able to use its affected limb.

Results

The animals were followed up periodically every 15 days by clinical and radiological examinations. No complications such as a deformation in the configuration of the apparatus, deformation of the pins, nonunion, osteomyelitis or neurovascular breakdown were observed.

The cases did not show any reaction to the CEFS, linear fixator or intramedullary pin and tolerated the apparatus very well. The intramedullary cases started using their extremities in postoperative between 20-25 days (mean 22 days). The linear external skeletal fixator cases started using their extremities in postoperative between 7-12 days (mean 9 days). The circular external skeletal fixator cases started using their extremities in postoperative between 1-6 days (mean 2 days). The radiographic examinations revealed that antebrachial deformities of extremity were corrected, and the consolidation was completed in postoperative days 32-57 (mean 40 days).

Discussion

The purpose of correcting angular limb deformities is to restore the mechanical axis and normal anatomical alignment of the limb. The association between limb malalignment and the subsequent development of osteoarthritis has been established and likely results from excessive forces placed on normal cartilage resulting from a shift in the mechanical axis of the joint (20).

The initial approach in correcting angular deformities is to first analyze the deformity using clinical and radiological examinations together (5, 32).

The radiographs must be on AP and ML planes. To minimize the magnification, the limb should be as close as possible to the cassette and the visual quality of the radiographs must be high. If the deformation is unilateral, radiographs of the unaffected limb must have the same qualities as they will be used as a guide. By making careful measurements from the radiographs, the angularity of the deformities on the AP and ML planes can be made (13, 22, 25, 26 28, 29, 36,). Using this clinical and radiological evidence to examine the deformities in the current study, the most appropriate configuration was determined for all cases.

Osteotomy is frequently used for the correction of deformities (10, 27, 30, 39, 41,) and any angular deformity can be corrected by open wedge, dome or closed wedge osteotomies. However, it is difficult to maintain stability in the open wedge method and a bone graft is usually needed to facilitate the union of the fragments. The closed wedge method provides a good level of stability by maintaining a large surface area for contact but requires a large incision and creates a length deficit in the limb. Dome osteotomy is capable of partially overcoming the disadvantages of the other two methods (19). In all cases in this study, a single and basic osteotomy was applied at the CORA point of the radius and ulna.

The medullary blood supply and periost were protected during the corrective osteotomies performed in this experiment. Problems such as nonunion, rotation, pin track infection, osteomyelitis and neurovascular damage are commonly seen following classical osteotomies (3, 10, 15, 22-24, 26, 28, 29, 30, 31, 33, 39). It should be kept in mind that performing the osteotomy in the metaphysis increases callus formation. Many factors such as the geometry of the deformity, fixation type, distance between deformities, physis site and proximity to a joint, as well as the amount of soft tissue and bone quality, are important considerations when correcting deformities.

Assessing the position with respect to the physeal growth plates and examination of the deformity by radiographs taken from both sides of the extremity are important tools in selecting the optimum treatment option (11, 34, 38,).

CESF is an external fixator system similar to other types of external fixator devices. The advantages of this system are the maintenance of stability and the reduced invasiveness of the pins resulting from their small diameter and the various directions in which they are inserted (5, 7, 17, 18,).

Hinges are usually used to correct angular deformities (20, 21, 26, 28, 29, 34) and determination of the hinge location is the most important stage of planning.

The hinges must be located on the correction plane, and their rotation axis must also be on the deformity axis. During the correction, compression will occur if the hinges are on the concave side of the deformation whilst distraction will occur if they are on the convex side (13).

The hinge plane was perpendicular to the deformity plane in order to provide compression, distraction and neutralizing forces on the osteotomy line. The hinges were angled according to the intended degree of correction and fixed at that position.

In conclusion, circular external skeletal fixator was better than linear external skeletal fixator and intramedullary pinning for correction of antebrachial deformities in dogs.

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