



Clinical Technique

Management of Subchondral Lucencies of the Medial Aspect of the Equine Antebrachiocondylar Joint



Elizabeth M. Santschi ^{a,*}, James S. Juzwiak ^b, Cliff Honnas ^c, Wade T. Walker ^d, Barbara Hunter ^e, Jeremy L. Whitman ^f, Michael A. Prichard ^f, James P. Morehead ^f

^a Department of Clinical Sciences, Kansas State University, Manhattan, KS

^b Manor Equine Hospital, Monkton, MD

^c Texas Equine Hospital, Bryan, TX

^d Chaparral Veterinary Medical Center, Cave Creek, AZ

^e Matamata Veterinary Services, Matamata, New Zealand

^f Equine Medical Associates, 996 Nandino Blvd, Lexington, KY, 40583

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ABSTRACT

The objective of this study is to describe the management and outcomes of eight horses with subchondral lucencies (SCLs) of the medial aspect of the antebrachiocondylar (ABC) joint. The medical records and radiographs of the carpi of 8 horses with SCLs of the medial aspect of the ABC joint were reviewed. Follow-up clinical information was obtained for 6–60 months (the median duration of 14 months). Treatment was successful if radiographic healing was apparent or lameness was reduced or eliminated. Four horses had SCLs in the distomedial radius (DMR) and four in the proximal aspect of the radiocarpal bone (RCB). Lameness was present in all horses with DMR SCLs and in one horse with an RCB SCL. Treatments included restriction of exercise ($n = 3$), intra-articular administration of corticosteroids ($n = 2$), or placement of a screw across the SCL ($n = 3$). Exercise restriction alone was successful in three nonlame horses younger than one year with proximal RCB SCL and intra-articular corticosteroid administration in the ABC joint in two horses aged 2 years or younger with DMR SCLs. A yearling with a large proximal RCB SCL and two horses aged 5 years or older with DMR SCLs were successfully treated with screw placement across the SCL. Exercise restrictions and intra-articular administration of corticosteroids were successful in management of DMR SCLs in five horses. Placing a screw across the SCL of three horses resulted in resolution of lameness and substantial improvement of the radiographic appearance of the lesion in the RCB or DMR.

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1. Introduction

Subchondral lucencies (SCLs) are areas of decreased subchondral bone density surrounded by marginal sclerosis that usually communicate with an adjacent joint. Subchondral lucencies can be primary with minimal cartilage damage and joint comorbidities or secondary to osteoarthritis with substantial cartilage damage, proliferative synovitis, osteophytes, and osteochondral fragments. Primary SCLs occur in many equine joints and can cause lameness that varies in severity and can be intermittent [1–3]. Primary SCLs were

initially described in the equine digit [1] but were soon reported in the medial femoral condyle (MFC) [2,4], which is considered the most common location [3]. Subchondral lucencies are uncommon in the equine carpus, and a small number have been reported in the second ($n = 3$), fourth (1), accessory (2), radial (7) and ulnar (3) carpal bones, and the distomedial radius (5) [1,2,5–9]. A subset of carpal SCLs on the axial aspect of the ulnar carpal bone is not considered the primary SCLs as they are the result of avulsion of the palmar intercarpal ligament [10] and do not cause lameness. This case series reports 8 horses with primary carpal SCL of the medial aspect of the antebrachiocondylar joint (ABC) joint, specifically the distomedial radius and proximal radiocarpal bone.

Antebrachiocondylar joint SCLs that are not causes of lameness have been discovered on radiographic surveys or evaluation of other conditions [5,6,8]. When ABC SCLs cause lameness, joint effusion and a positive response to local anesthesia direct carpal

Animal welfare/ethical statement: Horses were treated with the owners' knowledge of the risks and rewards of each procedure.

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* Corresponding author at: Elizabeth M. Santschi, Kansas State University, 1800 Denison Avenue, Manhattan, KS, 66510.

E-mail address: santschi@vet.k-state.edu (E.M. Santschi).

imaging (most commonly radiography) and SCL discovery [5–7,9]. There is no universal approach to SCL treatment [3]; however, the goals are to heal subchondral bone and cartilage and initially are achieved by reducing additional bone trauma and joint inflammation via exercise restrictions. Radiographic healing of an SCL appears as a loss of density of sclerotic bone in the margin and an increase of the trabecular bone pattern within the lucency. Limiting exercise can be successful in reducing lameness and promoting bone healing up to 14 months of age [3,6,8]. Intra-articular or intralesional corticosteroids to reduce inflammation and lameness [11] are often the next treatment, which is followed by surgical treatment when unsuccessful. Surgery can include debridement [3] and bone grafting [7] and has been reported in two horses with an ABC SCL that did not respond to rest [7,9]. Recently, the placement of screws across SCLs has been reported in the MFC, proximal radius, and proximal tibia with positive results for healing and lameness resolution [12–14] but has not been described in the carpus. The objective of this study is to describe the clinical events, radiographic appearance, management, and clinical outcomes of horses with SCLs of the medial aspect of the ABC joint.

2. Materials and Methods

Medical records, including carpal radiographs of 8 horses with SCLs of the medial ABC from 6 equine practices were reviewed. Antebrachiocarpal joint SCLs were discovered on carpal radiographs during lameness investigations or on survey radiographs of young Thoroughbreds. The Thoroughbred horses younger than 1 year came from a single practice of more than 4 years, and ABC SCLs were found using a keyword record search (lucency and cyst) of survey radiographic reports. The Standardbred horses came from two practices and were all the ABC SCLs discovered in a 4-year period. The two remaining horses were contributed by two practices consulting with the first author. All carpal radiographs were reviewed by at least two board-certified surgeons with extensive experience reading equine radiographs. Evaluation of SCL healing and lameness resolution within 60 days after treatment was determined by veterinarians, and longer follow-up performance information was obtained from veterinarians, owners, and online databases (Equibase Co. LLC, Lexington, KY).

Subchondral lucency healing was graded by one author by measuring the approximate void area using quantitative digital imaging software (Asteris Keystone, Monument, CO) on the dorso-palmar radiographic projection of the carpus before and after treatment and estimating the change in the SCL void area measured. Variations in the projection angle and potential magnification resulted in estimations of healing. Healing was graded as poor if the reduction in area was < 10%, minimal if 11–25%, moderate if 26–50%, and substantial if >50%. Follow-up lameness examinations were performed 2–3 months after treatment by veterinarians, and post-treatment radiographs (4 months–2 years) were reviewed by the same surgeons when available. Further follow-up performance information was obtained by email or phone contact with owners and veterinarians and/or from race records from horses sold at auction.

3. Results

3.1. Demographics

The breeds of affected horses were 3 Thoroughbreds, 3 Standardbreds, one Warmblood, and one Quarter Horse (Table 1). The ages of the four horses with distomedial radial (DMR) SCLs ranged from 4 months to 12 years, and the four horses with radiocarpal bone (RCB) SCL were aged 1 year or younger (5–12 months).

Table 1 Clinical events in horses affected with antebrachial carpal joint subchondral lucencies.

Case #	Breed	Age	Limbs affected	SCL Location	SCL Size, Height × Width	Lameness Grade, Duration	Initial Therapy	Subsequent Therapy	Clinical Follow-Up	Grade of Healing, Length Radiologic Follow-Up
1	TB	5 m	Right	Proximal radial carpal bone	10 × 8 mm	G0	Rest	Rest 60–90 days	12 m	Substantial, 12 m
2	TB	5 m	Right	Proximal radial carpal bone	11 × 8 mm	G0	Rest	Rest 60–90 days	12 m	Moderate, 12 m
3	TB	10 m	Left	Proximal radial carpal bone	11 × 7 mm	G0	Rest	Rest 60–90 days	12 m	Substantial, 12 m
4	STB	1 y	Right	Proximal radial carpal bone	15 × 15 mm	G4 4 weeks	Rest	Lag screw	6 m	Substantial, 4 m
5	WMB	12 y	Bilateral	Distomedial radius	L: 15 × 8 mm R: 6 × 4 mm	Left G3, 4 weeks	Rest	Lag screw	60 m	Substantial, 60 m
6	QH	5 y	Left	Distomedial radius	5 × 4 mm	G3–4	Lag screw	Rest	24 m	Moderate, 6 m
7	STB	4 m	Left	Distomedial radius	10 × 6 mm	G4 10 days	Rest	IA triamcinolone	16 m	Not done
8	STB	2 y	Left	Distomedial radius	10 × 5 mm	G3 7 days G3 4 weeks	Rest	IA triamcinolone	24 m	Minimal, 18 m

Abbreviations: WMB, warmblood; QH, Quarter horse; STB, Standardbred; TB, Thoroughbred; SCL, subchondral lucency; G0, not lame; G3, grade 3; G4, grade 4; IA, intra-articular.

3.2. Clinical Examination

All horses had normal physical examination findings. Subject lameness grades ranged from 0 to 4 [13]. Three Thoroughbreds aged 1 year or younger with radiocarpal bone SCL were not lame, and SCLs were discovered with survey radiography. In the five lame horses, pain was isolated in three (cases 5, 6, and 8) to the joint with the ABC using intra-articular anesthesia, and in two (cases 4 and 7), the ABC was the suspect source of lameness because of effusion.

3.3. Imaging

Antebrachiocarpal joint SCLs were best observed on the dorso-palmar carpal radiographic projection, and the size varied (Table 1). The proximal RCB SCLs in the three nonlame horses (cases 1–3) were within the proximal subchondral aspect of the RCB (Fig. 1). The yearling Standardbred with a large RCB SCL (case 4) was grade 4 lame and had ABC effusion. This SCL was central in the radiocarpal bone with a communication with the ABC joint (Fig. 2). The only additional radiographic abnormality present was periosteal proliferation on the dorsal surface of the RCB.

There were 4 horses (cases 5–8) with DMR SCL (Figs. 3–6). Two of these horses also had nuclear scintigraphy performed on the lame limb. In case 6, an area of intense radiopharmaceutical uptake was present at the distomedial aspect of the radius in the lame limb (Fig. 3A), and a faint SCL was apparent in that location (Fig. 3B). In case 8, scintigraphy indicated diffuse mild uptake in multiple sites in the carpus.

3.4. Treatments and Short-Term Outcomes

3.4.1. Conservative Therapy

Rest was the initial treatment for 7 of 8 horses (Table 1). Rest (reducing the paddock size and daily duration of exercise) for 60–90 days was sufficient to promote RCB SCL healing in 3 non-lame Thoroughbreds aged one year or younger (cases 1–3). In four

horses older than 1 year, lameness persisted after 1–4 weeks of stall confinement or small paddock exercise. Cases 7 and 8 with DMR SCL were then injected intra-articularly with triamcinolone acetonide (6 and 10 mg) and rest was continued. Case 7, a 4-month-old Standardbred filly with a large SCL (Fig. 4) had a rapid resolution of lameness after ABC joint injection. This horse was not reradiographed and was sold and lost to further clinical follow-up.

Case 8 was a 2-year-old Standardbred gelding that was racing successfully but developed left middle carpal joint effusion. On clinical evaluation, he was grade 2 lame in the left front and hind limbs and had back pain. Scintigraphy revealed increased radiopharmaceutical uptake in both hocks and both third carpal bones. Carpal radiographs revealed mild changes in the distal radial and proximal third carpal bones (very small osteophytes and sclerosis) and an indistinct DMR SCL (Fig. 5A). Owing to the effusion, the middle carpal joint was injected with 10 mg of triamcinolone acetonide followed by 2 mL of polyacrylamide hydrogel (Arthramid Vet, Contura Vet, Denmark) 30 days later. After 90-day rest, the horse was returned to training but a left forelimb lameness (grade 3) returned after two weeks of work and effusion was now present in the ABC joint. The lameness was relieved with intra-articular anesthesia of the ABC joint that was injected with 10 mg of triamcinolone acetonide. Carpal radiographs revealed that the DMR SCL margins were more distinct with peripheral sclerosis (Fig. 5B). The horse was gradually returned to work without lameness. Clinical examination 18 months after discovery of the SCL revealed a grade 3 lameness on a hard surface that reduced to a grade 1 on soft ground. Radiographs revealed a similar appearance of the DMR SCL (Fig. 5C); however, the distal radiocarpal bone had irregular lucencies and deeper sclerosis. The lameness was abolished by intra-articular anesthesia of the middle carpal joint. Arthroscopy of the ABC and middle carpal joints revealed a small area of cartilage irregularity covering the apparently normal subchondral bone on the distal radius and moderate to severe damage to the distal radiocarpal bone.

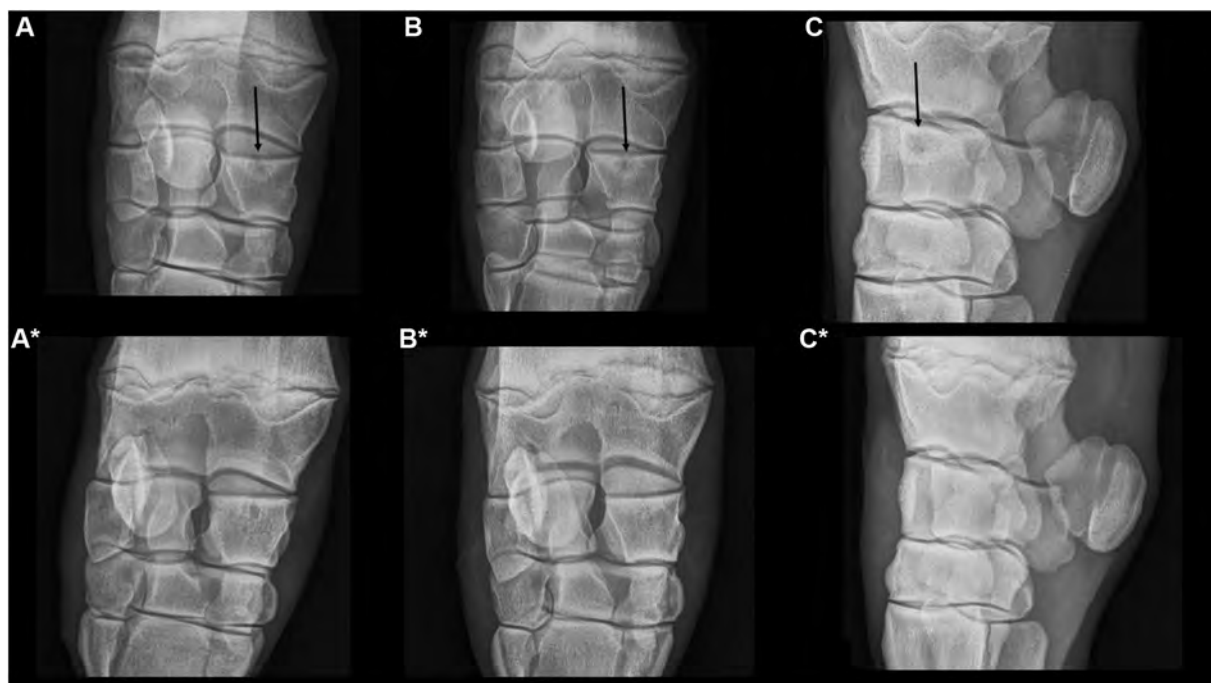


Fig. 1. Proximal radiocarpal bone lucencies (arrows) in three Thoroughbred foals (cases 1–3). Images in panels (A, B, and C) are obtained at approximately 6 months of age. Images in panels (A*, B*, and C*) are of the same horses at approximately 10 months later and demonstrate moderate to substantial bone healing.

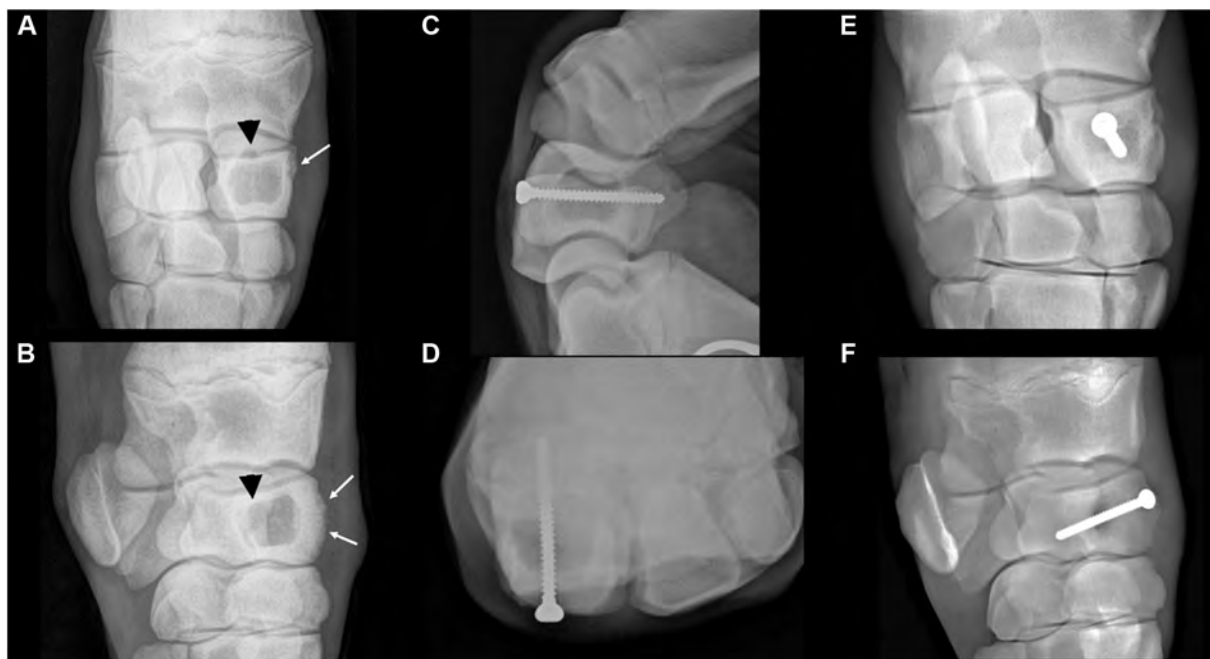


Fig. 2. Radiographs of the right carpus (case 4). Initial (A) dorsopalmar and (B) lateromedial oblique projections. There is a large proximal radiocarpal bone SCL (arrowhead) and irregular periosteal proliferation on the dorsomedial aspect of the proximal radiocarpal bone (arrows). (C) Lateral to medial and (D) intraoperative skyline radiographic projection of the proximal row of carpal bones after lag screw placement. (E) Dorsopalmar and (F) dorsolateral to palmaromedial radiographic projections 4 months after surgery that reveal substantial healing of the lucency and reduction in the dorsal periosteal reaction.

3.4.2. Surgical Therapy

In three horses, 4.5-mm lag screws were placed across SCLs (2 DMR and 1 proximal RCB) (Figs. 2, 3 and 6), ensuring a minimum of 20 mm of the bone on the threaded side of the SCL. Screw countersinking was unnecessary in the distal radius because of the fossa for the collateral ligament attachment and was only performed in the RCB SCL. Screw placement was chosen because rest had been unsuccessful in resolving lameness in the yearling with a large proximal RCB SCL and because of surgeon preference in two horses aged ≥ 5 years or older. Lag screw placement was performed in a similar fashion as reported for other locations using radiography to guide screw placement [13–15]. Arthroscopic examination of the ABC joint was performed in one horse (case 6) and revealed intact softened cartilage that was well attached to the subchondral bone and therefore was not debrided. Postoperative care included 2–4 weeks of stall confinement with gradually increasing amounts

of exercise for a total of 4 months after surgery. After screw placement, lameness resolved in the 3 horses within 3–6 months and performance resumed or began at that time. Radiographic SCL healing was substantial in 2 horses that received screws and moderate in the third.

3.5. Long-Term Follow-Up Results

The mean duration of clinical follow-up was 14 months, and the mean duration of radiographic follow-up was 12 months. Long-term outcomes for 2 lame horses (5 and 12 years old) treated with a screw were a return to previous performance (western performance and dressage). All three of the nonlame Thoroughbreds (aged <1 year) were sold at auction, 2 have raced, and the third is in training. All 3 Standardbreds (aged 4–24 months) have raced multiple times and are winners of stakes races.

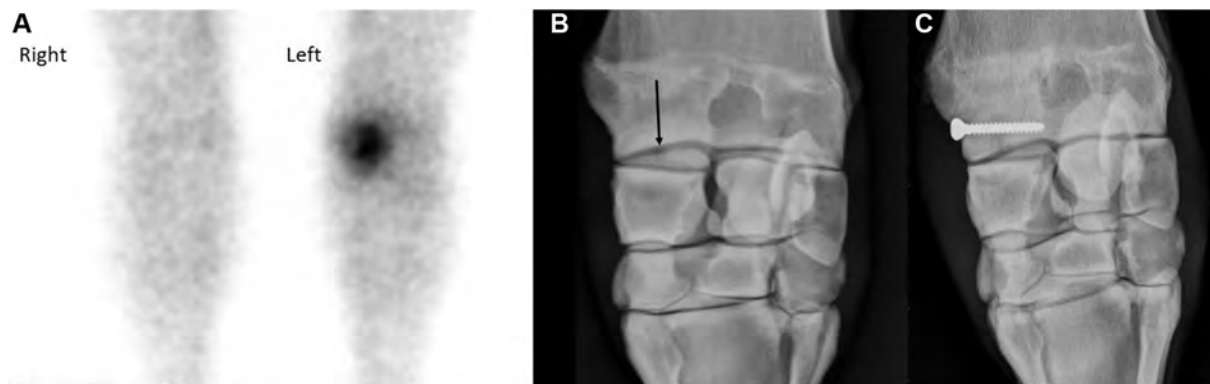


Fig. 3. Dorsopalmar scintigraphic and radiographic projections of case 6. (A) An intense area of radiopharmaceutical uptake is present on the left distomedial radius. (B) A 5 × 4 mm faint subchondral lucency with surrounding sclerosis is present in the left distomedial radius (arrow). (C) 6 months after placement of lag screw, bone production is present in the lucency at the articular aspect.



Fig. 4. Radiographs of the left carpus of a 4-month-old Standardbred (case 7). (A) Dorsopalmar radiographic projection: a 10 × 12 mm rounded lucency with marginal sclerosis is present on the distomedial aspect of the radius (arrow) that is confirmed on the (B) medial to lateral oblique radiographic projection (arrow).

4. Discussion

This small case series describes management of SCLs in the DMR and proximal RCB. Distomedial radial SCL occurred in horses aged 4 months to 12 years and proximal RCB SCL occurred in horses aged 1 year or younger. In nonlame Thoroughbreds younger than 1 year, reduced exercise was sufficient to promote healing of proximal radiocarpal SCLs that had a largest dimension of ≤ 11 mm. In lame horses aged 2 years or younger, intra-articular corticosteroids and rest reduced or resolved lameness, but radiographic healing of the SCL was poor or unknown. Placement of a screw across the distomedial radial SCL was successful in reducing lameness and promoting healing in 2 older horses and in a young horse with a 15 × 15-mm proximal radiocarpal bone SCL.

The treatment chosen for ABC SCL depends on the age of the horse, severity of lameness, and the size of the SCL. Our experience is that conservative treatment is more successful in healing SCL in horses younger than 1 year [14,16]. Young horses that are not lame are treated with reductions in paddock and group size and duration of turnout. Several studies have attempted to prove an association of reducing exercise and healing of juvenile orthopedic disease, but the complexity of the factors generally results in at best a weak association [16]. However, reducing exercise is noninvasive and relatively inexpensive. Rest in older horses is stall confinement with hand-walking when lameness is present and a small paddock turnout once lameness is < grade 3.

Intra-articular injection of the ABC joint with anti-inflammatories can be used in conjunction with a reduction in

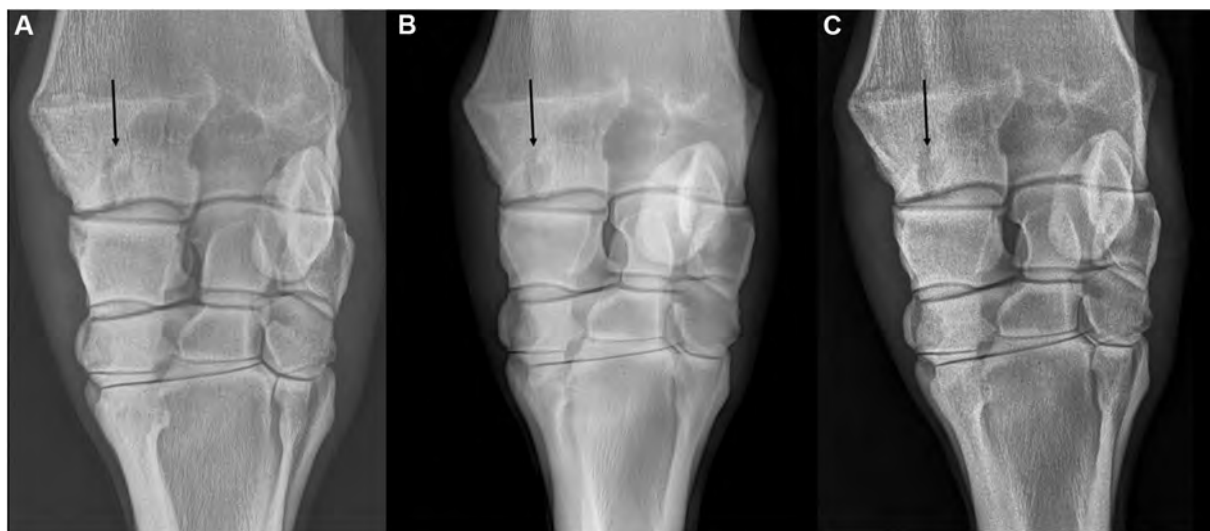


Fig. 5. Dorsopalmar radiographs of the left carpus of case 8. (A) Initial images. (B) After 4 months of rest and corticosteroid injection in middle carpal joint. The distomedial radial lucency is more distinct with minor healing at the articular surface. Corticosteroids were injected into the antebrachicarpal joint at this time because of persistent mild lameness. (C) One year after initial diagnosis, the lucency is unchanged.



Fig. 6. Dorsopalmar radiographic projections of the left carpus of case 5. (A) A 15 × 8 mm lucency (arrow) is present in the distomedial radius before surgery, and very small osteophytes are present on the proximal radiocarpal bone. (B) Two years after screw placement, there is substantial evidence of bone healing in the lucency and no increase in the osteophyte size.

exercise to treat SCLs. Inflammation is a component of SCL formation and lameness [17] in the equine MFC and is likely also a component of ABC SCLs. Intralesional corticosteroids have been advocated as a treatment of MFC SCLs, and the primary clinical effect is lameness reduction [11]. Radiographic evidence of bone healing after SCL injection is poorly described, and only 32% revealed any healing [11]. In young horses, intra-articular corticosteroids should be used sparingly as there is little data available on short- and long-term effects, but veterinarians have to balance the possible deleterious effects of corticosteroid use against the negative impact of persistent intra-articular inflammation on the subchondral bone. Because methylprednisolone acetate is established to have deleterious effects on cartilage and triamcinolone acetonide is chondroprotective [18], triamcinolone was injected intra-articularly in two lame horses with distomedial radial SCL. Post-treatment carpal radiographs could not be obtained for one horse after intra-articular steroid injection. The second horse raced well for 18 months despite having poor radiographic healing of the DMR SCLs. He eventually developed lameness because of damage to the distal radiocarpal bone of the same limb and is convalescing.

Lag screw placement across SCLs has been reported to reduce lameness and promote bone healing in the stifle, proximal radius, and proximal tibia [12,14,15] and was used in three horses in the present study. It was the only treatment that promoted radiographic healing of ABC SCLs in horses older than 1 year. At 12 years of age, case 5 was considered unlikely to heal without surgical intervention and had an uncomplicated convalescence. However, in case 6 (5 years old), lameness was slightly worse after surgery, and local soft-tissue swelling at the surgical site was present for 6 weeks. Owing to the short duration of lameness before surgery, it is possible that an actively inflamed SCL resulted in a more severe postoperative response. Screw placement was selected in both of these horses because of surgeon preference and the owners' wish for a rapid resolution. Case 4 is an unusual presentation of a large proximal radiocarpal bone SCL that did not heal with rest. Surgery was performed because of the failure of conservative therapy and was successful in eliminating the lameness and healing the SCL. The mechanism of lag screws' promotion of SCL bone healing has been suggested to be the result of redirection of bone strain to the void to encourage bone formation along the axis of compression [19]. Our

philosophy is that debridement of SCLs is unnecessary and can be counterproductive if the hyaline cartilage and subchondral bone are removed. Lag screw placement across an SCL preserves critical structures and promotes subchondral bone healing. It was useful in horses that failed to respond favorably to conservative treatment of ABC SCLs. Arthroscopic exploration of the joint can be performed in conjunction with screw placement to evaluate and remove damaged intra-articular structures and is most likely to be useful in aged horses.

This case series has several limitations, including its retrospective nature and the small number of horses. We regret the lack of longer follow-up radiographs for one horse with a distomedial radial SCL treated with intra-articular corticosteroids.

5. Conclusion

Treatment of SCL in the medial ABC joint can result in radiographic bone healing and a good prognosis for athletic performance. The initial treatment should be exercise limitations that can result in substantial radiographic bone healing in nonlame foals. Short-term intra-articular corticosteroids can be used for medial ABC SCLs when lameness is present; however, radiographic healing may not occur. Lag screw placement across SCLs can promote healing when SCLs cause lameness and do not respond to conservative treatment. Lag screw placement may be a useful treatment for horses older than 1 year with distomedial radial SCLs or in horses with large proximal radiocarpal bone SCLs.

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