Update on treatment on subchondral cystic lesions

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Subchondral cystic lesions (SCLs), also referred to as subchondral bone cysts or osseous cyst-like lesions (OCLLs), have been described in many equine joints. Nowadays we know, that many pathologic mechanisms can lead to the development of SCLs. In 1975, Rooney described subchondral cystic lesions of the equine stifle as manifestation of the osteochondrosis (OC) complex as result of retained, thickened, necrotic cartilage in the epiphyseal physis, that infolds into the subchondral bone in the weight-bearing areas of joint. Recent studies have demonstrated, that the disturbance in ossification in pigs and horses affected by osteochondrosis is the result of failure of the blood supply to epiphyseal growth cartilage and associated ischemic chondronecrosis.

Another pathologic mechanism responsible for the development of SCLs is trauma to the articular cartilage, subchondral bone or both, creating a communication between the subchondral bone and the joint, allowing synovial fluid to flow under pression in the subchondral region, producing necrosis of the adjacent bone and contributing to cyst formation. In a recent study evaluating the morphology of SCLs in limbs of horses it could be shown, that in almost 1/3 of the cystic lesions, a concomitant fissure was visible on CT.[1] Alternatively, trauma can cause subchondral bone damage and bone ischaemia and necrosis, followed by revascularisation and resorption of necrotic bone, leaving a subchondral lesion.[2] Lameness is attributed to increased intracystic or intraosseous pressure, or both.[3] In some cases, the diagnosis of a subchondral cystic lesion is made with radiographs.[4]
A typical radiographic finding is a dome shaped or round to oval subchondral lucency with a variable surrounding sclerotic rim. Some SCLs may be difficult to detect on radiography, and several projections may be necessary to see and recognize the extent of the lesions. In a recent study, of 42 SCLs of the equine limb diagnosed by CT, only 33(79%) were identified radiographically.[1]
Nonsurgical management of SCLs involves rest and the use of nonsteroidal anti-inflammatory drugs (NSAIDs). This type of treatment is not very successful, because one study reported a failure rate of 66%.[5] Limited exercise and intra-articular medication has a reported success rate of 64%, with horses less than 3 years of age having a better prognosis for soundness.

One author reported that horses resuming athletic activity following conservative management redevelop lesions. Benzopyrone has been used systemically in horses with SCLs, with 12 out of 19 horses returning to normal use.[6] Assuming that pain associated from these lesions originates from increased intraosseus pressure, this drug should decrease the osmotic pressure in the bone that leads to lameness.[6] Tiludronate, a non-nitrogen containing biphosphonate, inhibits osteoclast-mediated bone resorption and has been used in humans since 2007.[7] However, although clinical results show that tiludronate can improve lameness in horses with navicular diseases or with tarsal pain at 6-months, no long-term results are available,[7] and it still is unknown as to whether tiludronate can improve lameness in horses suffering from SCLs. Intraarticular injection of steroids is often the first approach to subchondral cystic lesions and leads to immediate improvement of the lameness; however, the risk of recurrence is very high.[8] The technique of injecting corticosteroids into the lining of the SCL under arthroscopic or ultrasonic guidance is based on earlier work, where inflammatory mediators were detected in the cystic contents leading to bone resorption. A success rate of 90% for unilateral and 67% for bilateral SCLs was reported.[9] Surgical treatment is the therapy of choice for horses lame because of a SCL, especially if refractory to conservative treatment. Surgical debridement is performed using either an intra-articular approach[4] by arthroscopy or a transcortical approach. The arthroscope is introduced into the affected joint using routine technique. The lesion is identified either through the presence of a canal when the SCL has a communication into the joint or by a slight indentation or a “Mercedes star” irregularity. Once the cyst has been identified, a rongeur can be used to remove the articular cartilage overlying the SCL. Once all the cartilage not supported by underlying bone is removed, the contents of the cyst are evacuated with the help of a curet or a shaver. All the contents and lining of the cyst are carefully removed, until the subchondral bone is visible. Most of the SCLs of the distal limb are not accessible through an articular approach and have to be debrided transcortically.
The surgery should be performed under digital radiography, fluoroscopy or CT guidance, and careful planning is very important. Although simple debridement and exposure of the subchondral bone promotes some migration of pluripotent stem cells (MSCs), this effect is minimal[9] and more advanced grafting is generally indicated in deeper lesions. Multiple grafting techniques have been developed and evaluated for their ability to accelerate and improve healing of the debrided SCL. Packing the lesion with autogenous grafts also has been recommended. However, a study comparing healing of surgically created subchondral defects filled with compacted cancellous bone grafts compared to empty defects revealed no difference in the healing patterns after 6 months.[10] Mosaic arthroplasty (autologous osteochondral grafting) has been studied as a potential treatment for SCLs. Osteochondral autograft transplantation (mosaic arthroplasty) was performed in a clinical case series, where grafts were harvested from the abaxial border of the medial femoral trochlea of the unaffected limb. [11] Tricalcium phosphate (TCP) granules can be implanted in SCLs following transosseous curettage.[12] Before implantation, granules are placed in a syringe, autologous whole blood is added, and a vacuum is applied for several minutes. Good results were reported with this technique; however, the population was small.[13]

Therapy with low-dose parathyroid hormone (PTH) analogues has become a popular treatment for severe osteoporosis of human beings, because, when administered systemically and intermittently, it has a strong anabolic effect on bone. In a clinical case series of 15 horses, lame because of a SCL at different anatomic locations, 11 became sound after debridement and filling of the lesions with $PTH_{1-34,}$ in a fibrin.[14] Autologous chondrocyte implantation (ACI) is the „gold standard" for repair of large cartilaginous lesions in man. In a recent study, Ortved et al. (2015) demonstrated improved healing in the short- (8 weeks) and long-term (8 months) following implantation of autologous chondrocytes transduced ex vivo with a self-complementary adeno-associated virus (AAV) overexpressing IGF-I in the equine femoral trochlea. More recent studies examined the potential beneficial effects of Bone morphogenetic protein (BMP)-2 in the repair of experimental equine osteochondral defects. In one study, the effect of rhBMP-2 in 3 horses suffering from 5 SCLs in the pastern joint was investigated: in all the three horses, treatment resulted in increased bone density, decreased cyst size, and an absence of lameness. In a recent study, 20 horses with lameness attributable to a SCL in the medial femoral condyle were treated with a transcondylar 4.5 mm screw inserted in lag fashion without debridement of the lesions. By 120 days lameness was eliminated in 15 horses, and the SCL area had decreased ≥50%. In another study, placement of a bone screw in the proximal-medial radius resulted in a substantial reduction in, or elimination of, lameness in 7/8 horses (88%). Another possible option is the combination of transcortical debridement and filling of the lesion and placement of a transcortical screw. SCLs of the distal limb are often of traumatic origin and in almost 1/3 of the cases concomitant fissure lines are present, when evaluated on CT.[1] Also in these cases, after debridement of the cystic lesions, a lag screw should be inserted to stabilize the fissure.[15] Recently, titanium spongiosa balls of 5 mm of diameter have been used as filling material after debridement of SCLs at various anatomical locations. Due to its high biocompatibility, titanium is regarded as the "gold standard" for dental implants in humans.

REFERENCES

1. Schon S, Furst AE, Ohlerth S, et al. Computed tomographic versus radiographic assessment of the visibility and features of subchondral cystic lesions in equine limbs. *Pferdeheilkunde* 2017;33:256-262.
2. Verschooten F, De Moor A. Subchondral cystic and related lesions affecting the equine pedal bone and stifle. *Equine Vet J* 1982;14:47-54.
3. Kold SE, Hickman J, Melsen F. An experimental study of the healing process of equine chondral and osteochondral defects. *Equine Vet J* 1986;18:18-24.
4. McIlwraith CW. *Diagnostic and Surgical Arthroscopy in the Horse*. 2. Auflage ed. Malvern, Pennsylvania, U.S.A.: Lea & Febiger, 1990.
5. von Rechenberg B, McIlwraith CW, Auer JA. Cystic Bone Lesions in Horses and Humans: A Comparative Review. *Vet Comp Orthop Traumatol* 1998;11:8-18.
6. Jackson M, Fricker C, Kümmerle J, et al. Die Behandlung von subchondralen zystoiden Defekten beim Pferd mit Benzopyron: eine retrospektive Analyse. *Wien Tierärztl Mschr* 2008;95:158-165.
7. Kamm L, MacIlwraight W, Kawcak C. A Review of the Efficacy of Tildudronate in the Horse. *Journal of Equine Veterinary Science* 2008;28:209-214.
8. Foerner J, Juzwiak J, Watt B, et al. Injection of Equine Subchondral Bone Cysts with Triamcinolone: 73 Horese. *AAEP Proceedings* 2006;52:412-413.
9. Wallis TW, Goodrich LR, McIlwraith CW, et al. Arthroscopic injection of corticosteroids into the fibrous tissue of subchondral cystic lesions of the medial femoral condyle in horses: A retrospective study of 52 cases (2001-2006. *Equine vet J* 2008;40:461-467.
10. Jackson WA, Stick JA, Arnoczky SP, et al. The effect of compacted cancellous bone grafting on the healing of subchondral bone defects of the medial femoral condyle in horses. *Vet Surg* 2000;29:8-16.
11. Bodo G, Hangody L, Modis L, et al. Autologous osteochondral grafting (mosaic arthroplasty) for treatment of subchondral cystic lesions in the equine stifle and fetlock joints. *Vet Surg* 2004;33:588-596.
12. Deiss E, Fürst A, Haas C, et al. Symptomatik, Diagnostik und Therapie von 5 Pferden mit traumatischen subchondralen Knochenzysten. *Wien Tierärztl Monatsschr* 2001;88:1-11.
13. Fürst A, Kaegi B, von Rechenberg B, et al. Die Behandlung von 5 Pferden mit subchondralen zystoiden Defekten im Fesselbein. *Pferdeheilkunde* 1997;13:147-161.
14. Jackson M, Ohlert S, Kummer M, et al. Use of a parathyroid hormone peptide (PTH1-34)-enriched fibrin hydrogel for the treatment of subchondral cystic lesions in 15 horses. *Pferdeheilkunde* 2012;28:642-649.
15. Brünisholz HP, Hagen R, Fürst AE, et al. Radiographic and Computed Tomographic Configuration of Incomplete Proximal Fractures of the Proximal Phalanx in Horses Not Used for Racing. *Veterinary Surgery* 2015:n/a-n/a.