

# Vitreotomy as a Diagnostic and Therapeutic Approach for Equine Recurrent Uveitis (ERU)

Hartmut Gerhards, Dr.Med.Vet.; Bettina Wollanke, Dr.Med.Vet.;  
and Siegfried Brem, Dr.Med.Vet.

Vitreotomy in horses suffering from recurrent uveitis can effectively stop uveitic attacks and enables an etiological diagnosis to be made in individual cases. Cessation of uveitis attacks is probably because of the removal of intraocular persisting leptospiral bacteria, proteins and cells which reside on the vitreous fibrils and cause the progression of intraocular inflammation. Authors' addresses: Dept. of Equine Surgery, Faculty of Veterinary Medicine, University of Munich, Veterinaerstr. 13, D-80539 Munich (Gerhards and Wollanke), and Veterinary Investigation Centre for Southern Bavaria, 2, D-85764 Oberschleissheim (Brem), Germany. © 1999 AAEP.

## 1. Introduction

Equine recurrent uveitis (ERU), "moon blindness," or "periodic ophthalmia" is a sight-threatening intraocular inflammatory disease, frequently encountered in equids of any age in all parts of the world. The disease presents as severe single attacks as well as recurrent minor inflammatory episodes. The concurrent corneal edema, proteinaceous and cellular exudates in the aqueous humor, inflammatory deposits and syncchia with pigment patches on the lens capsule, cataracts, and liquefaction and haziness of the vitreous causes opacities of the refracting media. The development of secondary cataracts and/or atrophy or detachment of the retina usually results in irreversible loss of vision. As horses with ERU need frequent veterinary assistance, and because the disease often terminates in blindness in one or both eyes, ERU causes considerable economic loss to the equine industry.

Despite extensive clinical and laboratory research, neither the etiology, nor the pathogenesis of ERU are

completely understood. The leptospiral etiology for ERU had been the most important one for more than 50 years. More recently, (auto-)immunologic processes are also considered etiologic events. The initiating factor as well as the cause for reactivation of the inflammatory response usually remain obscure in clinical cases. Therefore, conventional treatment is symptomatic, including mydriatics, corticosteroids, systemic anti-inflammatories, and supportive care. However, in a large number of cases, despite conservative treatment, the inflammation tends to recur at unpredictable intervals. In 1989, *Werry and Gerhards* introduced vitrectomy via pars plana sclerotomy as a surgical treatment for horses afflicted with the recurrent form of the disease.<sup>1</sup> Since then, more than 400 equine eyes in varying stages of the disease have been subjected to vitrectomy.

The purposes of this report are to describe the currently used technique for pars plana vitrectomy in horses and to report some long term surgical

---

## NOTES

## CURRENT NEWS TOPICS

outcomes, and additionally, to describe the results of serologic and cultural examinations of the vitreous material obtained by vitrectomy for leptospiral bacteria.

### 2. Materials and Methods

#### A. Criteria for Selection of Cases

Primarily, horses with a history of at least 2 or 3 uveitic attacks that were treated conservatively were considered as surgical patients. Also included among potential surgical candidates were a few horses with unknown or incomplete histories, for example, horses that had been pastured for a longer period without close observation, or recently purchased horses with characteristic uveitic changes found during ophthalmologic examination. All surgical candidates continued to suffer from recurrent uveitis, despite careful medical treatment. The presence of acute inflammatory signs, ulcerative keratitis, extensive posterior synechiae, mature cataract and retinal detachment were regarded as contraindications for vitrectomy, whereas hypotony was not. For patients with severe glaucoma (intraocular pressure [IOP] > 50 mmHg) and for patients with initial stages of retinal detachment, a poor prognosis for maintenance or improvement of vision was given. In 30 horses suffering from posterior synechia, beginning cataracts and ongoing uveitic attacks, vitrectomy was performed with the goal to prevent further attacks and to keep the horses serviceable, not with the expectation that vision could be improved at this stage of the disease.

#### B. Preoperative Medication

All animals are hospitalized at least 3 days prior to surgery. Treatment is initiated with atropine, antibiotic and corticosteroid eye ointments, and systemic nonsteroidal antiprostaglandin drugs. On the day of surgery, only gentamicin eye-drops and flunixin meglumine (1 mg/kg IV) are given. Ointments are not applied to the eye immediately preoperatively in order to avoid impaired vision during vitrectomy.

#### C. Surgery

After induction of general anesthesia with guaifenesin and thiamylal, anesthesia is maintained with halothane in O<sub>2</sub> and N<sub>2</sub>O. The animals are positioned in lateral recumbency with the affected eye uppermost. Eyelashes and tactile hairs are trimmed when necessary. The eyes are prepared for aseptic surgery by thoroughly irrigating the conjunctival sac and the periorcular skin with a gentamicin-balanced salt-solution (20 mg of gentamicin sulfate in 250 ml of balanced salt solution). After that, the closed eye and the area around the eye are dressed with adhesive sterile impermeable drapes. The head and neck are covered with sterile cloth drapes. A strong custom-built eyelid speculum is used to open the palpebral fissure. At this point, the depth of anesthesia is increased in order to provide ocular

immobility and corneal analgesia. After exposing the bulbar conjunctiva by gently rotating the globe with an instrument pressed in the ventral conjunctival sac, one or two scleral incisions are made with a CO<sub>2</sub>-Laser at 25 watts in the continuous wave mode, the laser beam being directed towards the center of the globe, and activated by a foot switch. The use of the CO<sub>2</sub>-Laser reduced the complication of intraocular hemorrhage, as compared to traditional methods (a cataract knife, e.g.) for performing the sclerotomy. A single incision is made at the 12 o'clock position when a combined irrigation/suction instrument is used. When separate incisions for the vitreous cutter and the infusion line are used, two incisions are made at the 11 o'clock and at the 1 o'clock position. The incisions are placed 14 mm away from the limbus in large horses, and 12 mm away from the limbus in smaller horses. An irrigation tip is introduced through one incision and secured in place with the help of preplaced sutures of monofil polyglecaprone (1 metric). A custom-built vitrectomy instrument is inserted through the other scleral incision, and the tip of the instrument is controlled transpupillarly with the aid of a head-mounted binocular indirect ophthalmoscope.

Vitrectomy is performed using a microprocessor controlled unit with automatic irrigation and aspiration pumps, maintaining a preset IOP of about 40 mmHg. The vitrectomy device operates with a magnetic-driven cutting head (600 cuts/min) which is surgeon-controlled by way of a foot pedal. The cutting head has a diameter of 1.6 mm and a length of 65 mm. Balanced salt solution (250 ml) with 20 mg of gentamicin sulfate is used as lavage fluid. After the cutter head is inserted into the vitreous chamber, the vitrectomy is started in the center of the vitreous. After the removal of filamentous vitreal structures, fibrin, cells, and "floaters" from the vitreous center, the vitrectomy is gradually extended towards the periphery. A small muscle hook is used to dent the sclera in order to bring the ciliary body transpupillarly in sight for removing inflammatory membranes from this region. Great care is taken not to touch the posterior lens capsule and the retina. Samples for leptospiral cultures and for leptospiral antibody titer determination can be obtained from the suction line. After all cloudy material and as much vitreous as possible has been removed from the vitreous chamber, the IOP is increased to 50 mmHg, the vitrectomy device is withdrawn from the inner eye, and the preplaced suture for the sclera incision is tied. After closure of the scleral incision for the infusion tip, the conjunctiva is closed using 1 metric polyglecaprone.

#### D. Postoperative Medication

After closure of the conjunctiva incision, a subconjunctival injection of 20 mg of gentamicin sulfate and 2 mg of aqueous dexamethasone is given, and neomycin ointment is administered to the conjunctival sac. No other topical treatment is used on the day of

surgery. Medical treatment starts on the first postoperative day, and includes topical atropine ointment (as needed), antibiotics (gentamicin eye ointment), corticosteroids (dexamethasone), or a combination of tetracycline/dexamethasone eye ointment (q 4 h), and oral phenylbutazone (4.0 mg/kg, q 12 h). This treatment regimen is continued for at least 3 days, and commonly for a duration of 5 days.

#### E. Patients

Four hundred thirty-three eyes of 403 horses and ponies have been subjected to vitrectomy between 1989 and May, 20th, 1999. The animals ranged in age from 2 to 22 years. All major breeds were represented. The sex was 56% geldings, 36% mares, and 8% stallions.

#### F. Examinations on the Leptospiral Etiology of ERU

Antibody titers to different leptospiral serovars were determined by microscopic agglutination test (MAT) in 399 serum samples from horses with ERU, and in 100 serum samples from horses without clinical and ophthalmoscopic signs of ERU. Additionally, antibody titers to different leptospiral serovars were determined by MAT in 324 vitreous samples of horses with, and in 30 vitreous samples of horses without, clinical and ophthalmoscopic signs of ERU. One hundred four undiluted vitreous samples, taken at the beginning of surgery, were prepared for leptospiral culture as described previously.<sup>2</sup>

### 3. Results

#### A. Complications

*Perioperative fatalities:* Eight horses (433 surgeries) died perioperatively. One gelding died because of a fatal anesthetic complication; 3 horses died because of postoperative pleuro-pneumonia (2 of them after discharge from the clinic); 2 animals died because of colitis X; and two others because of surgical colic and postanesthetic myopathy.

*Ocular complications:* All horses seemed comfortable after surgery, with only mild blepharospasm in the operated eye in a few cases. However, in about 10% of all cases, some degree of flare could be seen upon examination on the first and second postoperative days. In some horses, flare and a small amount of fibrin were present in the anterior chamber about 12 hours postoperatively. The fibrin was absorbed in all cases before discharge from the clinic on the 5th postoperative day. Two horses with chronic keratitis and corneal degeneration and with a history of repeated subconjunctival corticosteroid injections developed perforating corneal ulcers which made enucleation of the globe necessary. Another patient with a history of 7 uveitic attacks in one eye and 4 in the other eye developed a severe allergic reaction against atropine after surgery on the second eye. This caused extensive fibrin deposition in the anterior chamber on the 5th postoperative day, leading to blindness because of circular posterior syn-

echia and dense cataract. One horse with glaucoma had an expulsive hemorrhage into the anterior chamber during surgery, and 4 horses (one with glaucoma) had intraocular bleeding during recovery from anesthesia. Intraocular hemorrhage during surgery or during recovery from anesthesia, a major problem when a surgical blade was used for the sclerotomy, was no longer a concern because the incisions were made with a CO<sub>2</sub>-Laser. In one eye which had had 6 attacks of uveitis, considerable ocular hypotension, and complete retinal detachment before surgery, and in one eye with severe secondary glaucoma, in which surgery was performed in an attempt to preserve the globes, signs of bacterial endophthalmitis developed within 5 to 19 days after surgery (14 days after discharge from the clinic). These two globes had to be enucleated. Ten eyes which had some degree of retinal detachment (presenting as widespread peripapillary radiating grey striae) prior to surgery developed complete retinal detachment, which was diagnosed within the first three days after surgery, and one horse with severe posterior uveitis prior to surgery developed retinal detachment 4 days after discharge from the clinic.

*Long term results:* In 1995, 43 eyes from 38 horses with a shortest interval of 6 months and a longest interval of 67 months between surgery and follow-up examination were reexamined in their home stalls as reported previously.<sup>3</sup> The examination included history, a complete ophthalmological examination and measurement of IOP.

*Inflammation:* According to the horse owners, 42 of the 43 eyes had had no further uveitic attacks after surgery. In one horse, the attacks had ceased after a second surgery. Another horse had very mild symptoms of uveitis that could be controlled by medical treatment.

*Vision:* About 72% (31/43) of the horses included in the follow-up examination had vision in the eye operated on, 28% (12/43) were blind due to dense cataracts (6/12), to retinal detachments (3/12), to partial cataract and retinal detachment (1/12), or due to phthisis bulbi (2/12). In 17 of 31 horses with retained vision (17/31 = 55%), postoperative vision was improved as reported by owners by improved jumping performance, less head shaking, less signs of apprehensive behavior when approached from the affected side, and less head tilt. In 14 of 31 eyes (=45%), vision was maintained to some degree.<sup>3</sup>

*Intraocular pressure (IOP):* In 32 of 43 eyes (74%) IOP was normal. One eye, which had already suffered from glaucoma before surgery, still had ocular hypertension (57 mmHg). Four eyes had decreased IOP and phthisis bulbi. In 6 animals, the IOP could not be measured due to intractability.<sup>3</sup>

*Leptospiral antibody titer determination in vitreous material and in serum samples from horses with and without ERU, and leptospiral culture results:* In horses with ERU, 321 of 399 (=80%) serum samples and in horses without clinical and ophthalmoscopic signs of ERU, 78 of 100 (=78%) serum

## CURRENT NEWS TOPICS

samples had antibody titers to *Leptospira* of 1:100 or higher (Table 1). In 217 of 324 (=67%) vitreous samples from horses with ERU, antibody titers to *Leptospira* of 1:100 or higher could be detected by MAT. In the vitreous samples of horses without clinical and ophthalmoscopic signs of ERU, no antibodies to *Leptospira* could be detected at all (Table 1). The most common serovar was *Leptospira grippityphosa*. The highest detectable antibody titer to leptospira was 1:25,600 in the serum, and 1:409,600 in the vitreous.

Leptospiral cultures were positive in 41 out of 104 (=39.4%) undiluted vitreous samples. The eyes of the horses with positive culture results were in all stages of ERU, in some eyes there were hardly any ophthalmoscopic changes, and others had beginning cataracts or retinal detachments. In 40 positive leptospiral cultures, the determination of the serogroup of the cultured leptospirae was possible: 32 × serogroup *grippityphosa*, 5 × serogroup *australis*, 2 × serogroup *javanica*, and 1 × serogroup *pomona*.

In 4 of 41 horses with ERU and positive leptospiral cultures from the vitreous, no antibodies to *Leptospira* could be detected in the serum by MAT, and in 23 of these horses the antibody titers to *Leptospira* in the serum were lower than in the vitreous.

#### 4. Discussion

Because the quiescent period between attacks and the degree of severity of the next attack of recurrent uveitis in horses are unpredictable, effective prophylactic treatment is difficult or even impossible in practice. In sports horses, for example, legal aspects (doping) prohibit prolonged administration of anti-inflammatory drugs, or the use of horses receiving anti-inflammatory drugs in competitions. Based on the experience that, in a large number of horses with severe ERU, ocular damage and blindness cannot be prevented despite careful and prolonged

medical treatment, vitrectomy has been used in equine patients with chronic ERU in the quiescent period after at least 2 or 3 uveitic attacks.<sup>1,6</sup> Vitrectomy had been found to effectively reduce the inflammatory activity in uveitic eyes of human patients,<sup>4</sup> and in experimental uveitis in rabbit eyes.<sup>5</sup> Initially, in horses with ERU, vitrectomy was performed to remove opacities from the vitreous in order to preserve or even to improve vision. Later on it was noticed that *pars plana* vitrectomy also can effectively combat uveitis relapses. This was confirmed in a recently published follow-up study. It was found that more than 95% of the horses operated on had no further uveitic attacks and could be kept serviceable.<sup>3</sup> As only horses with a history of severe and relapsing uveitis had been included in the patient group, this result is remarkable. Because blindness and further painful attacks is the expected outcome without surgery, cataracts and retinal detachments in some horses were not a major concern to the owners. It is our experience that even if progression of a beginning secondary cataract is to be expected, most owners prefer to have vitrectomy performed on a horse with recurrent uveitis if there is a chance of stopping the ongoing painful inflammation by surgery. It is concluded, however, that in order to avoid or to reduce the development of postoperative cataracts or retinal detachments, vitrectomy should not be delayed until posterior synechiae, noticeable deposition of inflammatory debris on the anterior or posterior lens capsule, and beginning retinal detachments are present. In order to minimize the occurrence of postoperative retinal detachments, in recent years, horses with severe vitreous opacities have been subjected to ultrasound examination of the fundus, and electroretinography is used to evaluate the functional status of the retina. This and the use of the CO<sub>2</sub>-Laser for the sclerotomy may have contributed to a smaller incidence of retinal detachments following *pars plana* vitrectomy in the last 3 years compared to the incidence in earlier years. At this point, the incidence of complications after vitrectomy is within the limits of established surgeries.

The results suggest that *pars plana* vitrectomy is very effective in controlling the inflammatory attacks in horses with chronic ERU. Although it cannot be excluded that in some horses of the follow-up study the uveitic attacks may have ceased purely by chance after surgery, not as a result of vitrectomy, the results of long term follow up confirmed that recurrence of uveitis is extremely rare.

The results of the cultural and serological examinations of the vitreous material confirm that intraocular persisting leptospiral infection is a major cause for ERU in our patients, and that the etiologic diagnosis can better be based on the determination of antibody titers in the vitreous samples than on the determination of antibody titers in the serum samples. With the help of vitreous material collected during vitrectomy it could also be demon-

Table 1. Antibody Titers (AT) to *Leptospira* (LS) in Serum Samples and in Vitreous Samples from Horses with ERU (ERU +) and Without ERU (ERU -).

AT to LS	Serum (ERU +)	Serum (ERU -)	Vitreous (ERU +)	Vitreous (ERU -)
negative	78 (19.5%)	22 (22%)	107 (33%)	30 (100%)
1:100	71 (17.8%)	17 (17%)	29 (9%)	0
1:200	77 (19.3%)	18 (18%)	31 (9.6%)	0
1:400	89 (22.3%)	19 (19%)	42 (13%)	0
1:800	38 (9.5%)	15 (15%)	30 (9.3%)	0
1:1,600	29 (7.3%)	7 (7%)	35 (10.8%)	0
1:3,200	12 (3%)	1 (1%)	16 (4.9%)	0
1:6,400	2 (0.5%)	0	7 (2.2%)	0
1:12,800	2 (0.5%)	1 (1%)	9 (2.8%)	0
1:25,600	1 (0.3%)	0	7 (2.2%)	0
1:51,200	0	0	5 (1.5%)	0
1:102,400	0	0	3 (0.9%)	0
1:204,800	0	0	2 (0.6%)	0
1:409,600	0	0	1 (0.3%)	0
Σ	399	100	324	30

## CURRENT NEWS TOPICS

strated that an autoimmune reaction is present in eyes of horses with ERU.<sup>7</sup> Probably this autoimmune reaction is induced and maintained by intraocular leptospiral infection. The removal of pathologically changed vitreous with activated inflammatory cells, inflammatory mediators, and bacteria which may reside on or between the vitreous fibrils might be one reason for the effectivity of vitrectomy in horses with ERU. Thus, vitrectomy aids in finding an etiological diagnosis in individual cases with ERU and helps to bring about a better understanding of the recurrent nature of the inflammation and to develop better regimens for prophylaxis and treatment of ERU.

#### References

1. Werry H, Gerhards H. Zur operativen Therapie der equinen rezidivierenden Uveitis. *Tierärztl Prax* 1992;20:178–186.
2. Brem S, Gerhards H, Wollanke B, et al. Intraocular leptospira isolation in 4 horses suffering from equine recurrent uveitis (ERU). *Berl Muench Tierärztl Wochenschr* 1998;111:415–417.
3. Winterberg A, Gerhards H. Langzeitergebnisse der Pars-plana-Vitrektomie bei equiner rezidivierender Uveitis. *Pferdeheilkunde* 1997;13:377–383.
4. Werry H, Honegger H. Pars-plana Vitrektomie bei chronischer Uveitis. *Klin Mbl Augenheilk* 1987;191:9–12.
5. Brinkman CJJ, Otto AJ. Role of the vitreous in experimental uveitis. In: Boeke WRF, Manthey KF, Nussenblatt RB, ed. *Intermediate uveitis*. Developments in ophthalmology, vol. 23. Basel, Munich, Paris: KARGER Bertelsmann Foundation, 1992;226–231.
6. Gerhards H, Wollanke B. Vitrectomy as a treatment for recurrent uveitis in horses, in *Proceedings*. 5th WEVA Congress, IInd. Part, *Rivista SIDI* 1997;4:105–109.
7. Deeg CA, Gerhards H, Wildner G, et al. Immune response in eyes of horses with recurrent uveitis. *Ocular Immunology and Inflammation* 1998;6 (Suppl.):11. (Abstract)