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Outcome of Pars Plana Retinopexy with Perfluoro-*n*-octane-Silicone Oil Exchange for Rhegmatogenous Retinal Detachment in Dogs: 9 Eyes

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Abstract : This study was performed to describe the outcome of pars plana retinopexy with perfluoro-*n*-octane (PFO)-silicone oil (SiO) exchange in dogs with rhegmatogenous retinal detachment in Seoul National University Veterinary Medical Teaching Hospital (SNU VMTH) from 2014 to 2017. Nine eyes of 8 dogs were included in this study. Medical records including signalment, history, duration from onset of blindness to surgical intervention, pre-operative findings, duration from surgery to regaining vision, and post-operative complications were evaluated. No eyes were visual before surgery. Duration from onset of blindness to surgical intervention was 2-30 days (median 8 days); duration from surgery to regain vision was 1-14 days (median 6 days); follow-up time was 15-1088 days (median 69 days). Post-operative complications were divided as temporary vs permanent conditions. Temporary complications were corneal ulcer, uveitis, retinal haemorrhage, glaucoma, subconjunctival leakage of SiO, and vitreal haemorrhage. Permanent complications were anterior chamber migration of SiO, retinal degeneration, corneal degeneration, re-detachment, and cataract. Six of 9 eyes regained functional vision, five of which remained visual throughout the follow-up time while the other one lost vision after 3 months because of uveitic glaucoma. In conclusion, pars plana retinopexy with PFO-SiO exchange provided fair outcome in 66.7% cases described in this study.

Key words **:** Retinopexy, Retinal Detachment, Rhegmatogenous, Blindness, Dog.

Introduction

Retinal detachment refers to the separation of the sensory neuroretina from the retinal pigment epithelium which were derived from two embriologically distinct layers and therefore are easily separated because of the potential space between them (6). Possible causes of retinal detachment are including congenital disorder such as retinal dysplasia, accumulation of fluid beneath the retina which result in serous detachment, contraction of vitreal traction band or pre-retinal membrane which result in traction detachment, and the entering of liquefied vitreous into subretinal space through retinal tear which result in rhegmatogenous detachment (2,6,9).

In the case of rhegmatogenous retinal detachment, vitreous body plays an important role in its pathogenesis. Abnormal liquefied vitreous is known to be responsible for rhegmatogenous retinal detachment in several breeds of dogs including Shih Tzu and Poodle which has the tendency to violently shake their heads while playing with toys and thus can result in retinal tearing (9). Aside from vitreous degeneration, it has also been proposed that retinal degeneration is also one of the factors in rhegmatogenous retinal detachment in Shih Tzu in which retinal thinning makes it even more prone to tearing (5).

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Treatment option for retinal detachment consisted of medical therapy or surgery, depending on the nature of the retinal detachment itself. Retinal detachment associated with hypertension is usually manageable by medical therapy otherwise surgical treatment is needed in general (6). One of the most common surgeries to treat retinal detachment is pars plana retinopexy with perfluoro-*n*-carbon (PFO)-silicone oil (SiO) exchange in which silicone oil is injected into the eyes as a tamponade for the detached retina (1,8). This study described the outcome of pars plana retinopexy with PFO-SiO exchange in dogs with rhegmatogenous retinal detachment.

Materials and Methods

Medical records from nine eyes of 8 dogs underwent retinopexy in SNU VMTH from 2014 to 2017 were evaluated. The criteria for inclusion into this study were rhegmatogenous retinal detachment cases (Fig 1A) that had been surgically treated with retinopexy using PFO-SiO exchange technique.

The data collected from each patient were signalment, history, duration from blindness to surgical intervention, preoperative findings, duration from surgery to regaining vision, and post-operative complications. Signalment collected including age, sex, breed, operated eye, etiology of retinal detachment, and history of ocular surgery or trauma. Preoperative findings were including the visual state of the patients, the presence of menace response, pupillary light

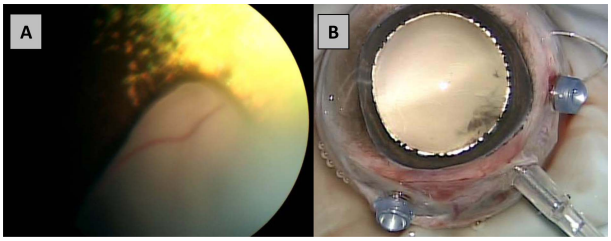

Fig 1. Retinopexy in dogs. (A) The fundus picture of detached retina; (B) Partial sclerotomy at pars plana with 20G port to facilitate retinopexy.

reflex, dazzle reflex, IOP, the presence of aqueous flare, lens status, vitreal status, and general appearance of the retina and its structure. Ocular abnormalities that noted post-surgery through out the follow-up time was regarded as surgical complications.

The retinopexy surgery was defined as successful if the retina were successfully reattached regardless it regained vision or not. Duration from surgery to regaining vision was evaluated from 24 hours post operation to the return of vision which was assessed by positive menace response, visual placing, and/or maze test. Every countable parameter including duration from onset of blindness to surgery, duration from surgery to regaining vision, and follow up time were calculated for its median. The duration from blindness to surgical intervention was taken from the time the animal was noticed to be blind by the owner to the time of surgery being performed. However, if such information was unavailable the onset of blindness was considered to be the time retinal detachment being diagnosed by the veterinarian.

The preoperative anaesthesia given was varied from medetomidine (0.2 μg; Domitor®, Zoetis, Korea), acepromazine (0.005 mg/kg; Sedaject®, Samu Median co., Korea), diazepam (0.2 mg/kg; Samjin, Korea) and midazolam (0.2 mg/kg; Bukwang Pharmaceutical Co., Korea) intravenously followed by the induction of anaesthesia by alfaxalone (2 mg/kg; Alfaxan®, Careside, Korea) or propofol (4 mg/kg; Provive®, Myungmoon Pharm, Korea) intravenously and maintained on isoflurane (Ifran®, Hana Pharm, Korea). The area around the operated eye was shaved and scrubbed with povidone solution and the patient was positioned in dorsal recumbency with the head deviated medially. Lateral canthotomy was done to partially proptosed the eyeball in order to achieve sufficient globe exposure. Pars plana vitrectomy with PFO (Okta-line™, Bausch&Lomb, UK)-SiO (5700 cSt, heavy weighted; Oxane®, Bausch&Lomb, UK) exchange and diode endolaser retinopexy was performed with 20G probes as described by Vainisi and Wolfer (9) in which three 20 G probes were introduced into the pars plana after sclerotomy (Fig 1B) and proceeded with vitrectomy followed by injection of PFO into the vitreal chamber to unfold the retina. Once the retina was flattened, laser coagulation was used to seal it back into the choroid after which the PFO then aspirated and exchanged with SiO. The sclerotomy was resutured and the partially proptosed eyeball was placed back into the eye socket. Partial tarsorrhaphy was placed for one week to protect the operated eyes. All the surgeries were performed by the same veterinary surgeon at the same facility.

Routine postoperative medications consisted of topical and systemic medications. Topical medication given was including topical antibiotic of either fluoroquinolone (Vigamox®, Alcon, Novartis, Korea) or neomycin polymixin B with steroidal anti-inflammatory combinations (Maxitrol®, Alcon, Novartis, Korea; Prednisolone acetate 1%; Pred Forte®, Allergan, Korea, or loteprednol; Lotemax®, Bausch & Lomb Korea Ltd, Korea) TID-OID, or NSAIDs (Flurbiprofen Sodium Ophthalmic Solution USP, 0.03%, Ocufen®, Baush Lomb, Korea). Anti-glaucomatic drugs also given as needed which is either dorzolamide (Trusopt®, Santen, Korea) or bimatoprost (Lumigan®, Allergan Pharmaceuticals, Korea) or both. Mydriatic agent either atropine (Isopto Atropin®, Alcon, Novartis, Korea) or tropicamide (Mydriacyl®, Alcon, Novartis, Korea) SID-TID were also prescribed if needed. The systemic medicine given including prednisolone (0,5 mg/kg SC; Prednisolone, Sam Woo Median, Korea), cefalosporin (30 mg/kg IV; Cefazolin®, Jonggeundang Pharm, Korea) and famotidine (0.5 mg/kg IV; Gaster®, Dong-A Pharm., Korea).

Results

Nine eyes of 8 dogs were included in this study, all of which had rhegmatogenous retinal detachment. Out of eight, 5 were Shih Tzu, while the remaining three were Maltese, Bichon Frise, and Poodle. The median age was 3.5 years (ranging from 6 months to 9 years). All the dogs were females except one castrated males. Of all the females, three were intact and four were spayed.

Of the nine eyes that underwent retinopexy, five were OD and four were OS. Only one dog underwent retinopexy in both eyes which were done at a different time. One of the eyes had scleral laceration by cat claws which underwent suturing on the lacerated sclera before experiencing retinal detachment and was likely to be the causative of the retinal detachment.

None of the eyes were visual before surgery. Duration from the onset of blindness to surgery was ranging from 2 to 30 days (median 8 days). Six eyes regained functional vision while the other three never regained functional vision. Of the six eyes that regained functional vision, one of them lost the vision after three months because of uveitic glaucoma. Duration from surgery to regaining vision was 1 to 14 days (median 6 days). Of the three eyes that failed to regain functional vision one of them had a weak positive menace response one day post surgery and maintained that for six days but eventually never regained functional vision. On this eye, the IOP was high from the first presentation throughout a few weeks after surgery despite the glaucoma medicine given which could be the reason the eyes failed to regain functional vision. The other two eyes that failed to regain-functional vision had intraocular haemorrhage that was failed to resolve. The range of follow-up time was 15 to 1088 days (median 69 days).

Immediate anatomical successes following the surgery were noted in 100% of the patients although later 4 of 9 eyes experiencing peripheral re-detachment. Of this four, three

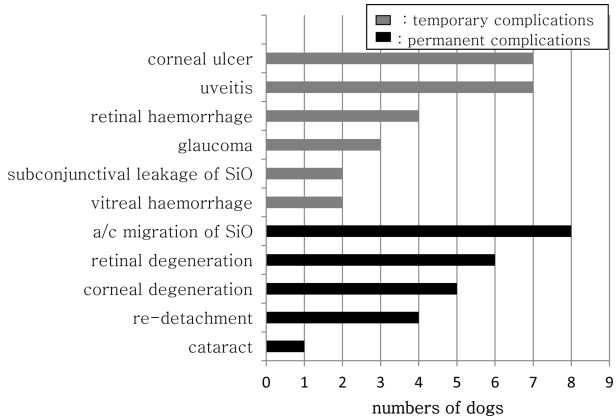

Fig 2. Post-operative complications of retinopexy.

were the eyes that failed to regain functional vision while one was the eye with the longest known follow up and were still remained visual. The postoperative complications were classified as either temporary or permanent conditions (Fig 2). Temporary complications were corneal ulcer (7/9), uveitis (7/9), retinal haemorrhage (4/9), glaucoma (3/9), subconjunctival leakage of silicone oil (2/9), and vitreal haemorrhage (2/9). Permanent complications were anterior chamber migration of silicone oil (8/9, Fig 3A and 3B), retinal degeneration (6/9, Fig 3C), corneal degeneration (5/9), re-detachment (4/9), and cataract (1/9).

Discussion

In the recent study, some preoperative clinical findings had been associated with return or maintaining of vision following retinopexy which were a relatively good appearance of retinal architecture, presence of menace response and dazzle reflex (7). On that regards, all the eyes that undergone retinopexy in this study had a generally good appearance and anatomical structure such as prominent blood vessels and no over significant tearing that otherwise complicate the reattachment surgery.

The small number of retinopexy surgery in this study population was due to the very selective patient candidate to undergo the surgery, especially on how good the anatomical structure of the retina and how long it had been detached. Despite it has been reported that a chronically detached retina, ranged from 1 to 6 months, had been surgically reattached successfully (3) it has been a general consideration to perform retinopexy on the best candidate as possible. Because of this factor, the immediate anatomical success was 100% in this study even though later 4/9 of the eyes developed re-detachment but this was considered as a complication rather than surgical failure.

The complications were classified into temporary and permanent complications. With temporary complications were generally treatable either with medical therapy or minor surgical correction. The permanent complications, on the other hand, were considered a permanent condition. Despite the small population in this study, all of the complications seen were mostly consistent with the previous study of larger population on retinopexy with similar procedure of PFO-SiO exchange by Steele *et al* (2012) and Spatola *et al* (2015) with the exception for cataract development which was only encountered in 1/9 eyes in this study. This was mainly because in this study we didn't consider cataract formation as a complication from the surgery if the contralateral eye also had a cataract or if cataract was exist before the retinopexy.

Some parameters used on assessing other complications also different from the previous studies such as corneal ulcer which was only considered to be a surgical complication if it was occurring during two weeks after surgery, and corneal ulcer developing after that time period would be considered from other cause. This was also applied for uveitis which was only being considered as a complication if it didn't resolve within the time frame of two weeks post surgery or if it was a recurring condition.

In this study, among seven eyes that developed uveitis, one of them eventually lost the vision after three months. In the previous studies, it was reported that some of the eyes that managed to regain vision were eventually lost the vision with glaucoma as the leading cause, accounted for almost half of the patient who lost vision in both of the studies (7,8). In the previously mentioned eyes, the uveitis was also concurrently accompanied by glaucoma with iris bombe occurring at some point. Silicone oil migration into the anterior chamber was observed in this eye before the development of glaucoma which could be the cause of glaucoma as silicone oil migra-

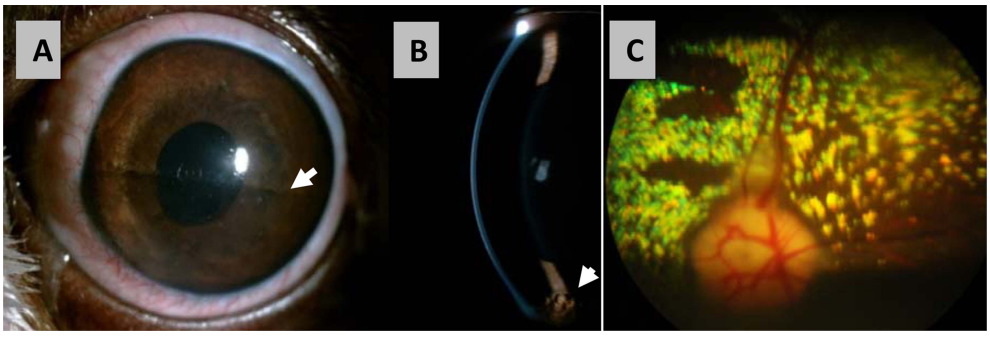

Fig 3. Complications following retinopexy. (A) Silicone oil migration filling half of anterior chamber (arrow); (B) Small droplets of silicone oil that migrated into the anterior chamber (arrow head); (C) Fundus picture after retinopexy showing some degree of retinal degeneration.

tion into the anterior chamber is known to block the iridocorneal angle drainage and thus disrupt the aqueous humour outflow (9). It was also interesting to note that from the first time being presented this eye had posterior synechia which could predispose the development of iris bombe and could also suggest the history of pre-existing uveitis.

Aside from causing secondary glaucoma by potentially block the iridocorneal angle and/or pupil, the presence of silicone oil in the anterior chamber are also known to damage the corneal endothelium resulting in keratopathy and corneal oedema (9). In this study, 8 of the 9 eyes had silicone oil migration to the anterior chamber. Except for one eye where silicone oil migration filled almost half of the anterior chamber (Fig 3A), the majority of silicone oil migration (7/8) was only observed in a small amount with no corneal oedema observed nor IOP elevation which otherwise necessitate the surgical removal of the silicone oil (Fig 3B).

In this study, we included retinal degeneration as a complication based on clinical fundus appearance observed through indirect ophthalmoscopy which was defined by tapetal hyperreflectivity and/or the attenuation of retinal blood vessels which were observed in 6/9 eyes in this study (Fig 3C). Among those six, two of them were still visual on the 1088 and 500 days of follow up. Assessing the degree of retinal degeneration in retinal detachment patient can be complicated because of many factors contributing to it. Following retinal detachment, the outer retina rapidly become ischemic due to choroidal blood supply lost which followed by photoreceptor outer segment loss and eventually will lead to atrophy of the entire photoreceptor layer (2). However, these degenerated retinas will readily regenerate following reattachment surgery albeit with some degree of changes persist in cellular level (2,4). In that regards, it is hard to justify the retinal degeneration down to the cellular level only through direct or indirect fundus examination in a clinical setting. Furthermore, because of the degree of degeneration are also highly depending on how long the retina had been detached before surgery it is also difficult to justify the progressing of degeneration after the surgery (7).

In conclusions Pars planaretinopexy with PFO-SiO exchange provided a fair outcome in dogs with retinal detachment in 66.67% cases described in this study.

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