1. INTRODUCTION

Eyes are the unique organs of vision. They detect light and convert it into electro-chemical impulses in neurons. In higher organisms, the eye is a complex optical system which collects light from the surrounding environment (Gelatt, 2000). Cornea along with the lens focus light on to the retina to produce a combined refractive capacity of approximately 60 Dioptre, out of which cornea accounts for 40 Diopter due to its curvature and high refractive index. Therefore, corneal pathologies should be treated at an earliest (Glove and Constantirescu, 1997).

The normal cornea is a clear transparent structure composed of several layers: epithelium, subepithelial basement membrane, stroma, descemet’s membrane and endothelium Moore (2003). These layers contribute to the cornea’s unique transparency by providing a non-keratinized surface, maintaining control of its water content and of its highly organised arrangement of collagen fibrils and ensuring the absence of blood vessels and pigment (Barnett, 2008).

Dogs are affected by various ocular disorders, some of the most common are cataracts, glaucoma, corneal ulcer, corneal opacity, lens luxation, cherry eye, uveitis, corneal dystrophy and dry eye. Corneal ulceration or ulcerative keratitis, is one of the most common extra ocular diseases identified in dogs. Corneal ulcer results due to break in the continuity of corneal epithelium that exposes the underlining corneal stroma (Slatter and Hakason, 1993).

In most of cases the cause of corneal ulcers is corneal trauma, however, foreign body, eyelid abnormalities, aberrant cilia, exposure and keratoconjunctivitis sicca (KCS), should also be considered as the causative factors (James et al., 2006). Corneal ulcer is characterized by varying degrees of lacrimation, blepharospasm, photophobia, conjunctival hyperemia, corneal oedema, miosis and aqueous flare and diagnosed by the retention of topically applied fluorescein dye by the corneal stroma (Gelatt, 2000). This test also classifies different type of corneal ulcers based on the depth of corneal involvement as superficial and deep ulcer. Uncomplicated superficial
ulcer heals rapidly, with mild scar formation, however, complicated deep ulcers, infected with microbia may lead to impaired vision (Miller, 2001).

Irrespective of the cardinal appearance and diagnosis the globe and adnexa must be evaluated for any abnormalities that could be causing the persistent epithelial defect such as foreign bodies, aberrant cilia, etc. A swab of the conjunctival and corneal surface should be taken for bacterial culture early in the examination, prior to the instillation of any drops, in those eyes that exhibit an abnormal discharge other than just a serous tear (Whitley and Gilger, 1999).

The principles in treatment of corneal ulcer include removal of the primary cause, reduction of inflammation, control of infection, enhancement of corneal healing and minimization of corneal scar. Healing of the ulcer can be promoted surgically by the use of tissue adhesives, soft contact lens, suturing, conjunctival flaps and grafts (Simon et al., 2009).

Most commonly used eye drops Gentamicin, ciprofloxacin, chloramphenicol and tobramycin had a high efficacy against bacterial infection but now a days fourth generation fluoroquinolones like moxifloxacin, gitifloxacin etc. provide broad-spectrum, high-potency antimicrobial efficacy, with deep ocular penetration. It is well tolerated non-toxic and non inflammatory drug (Ledbetter et al. 2007).

Surgery still remains the effective treatment of corneal ulcer. Temporary tarsorrhaphy and third eyelid flap surgery are used to protect the cornea during a short period exposure and both are performed to treat the infected corneal ulcer, which is taking a long time to heal (Wilkie and Whittaker 1997).

Looking to the high detrimental effect of corneal ulceration in dog there is need to evaluate newer antibiotic and anti inflammatory drugs to promote corneal ulcer healing. Therefore the present study was designed with the following objectives:

1. To determine the incidence of various eye affections in dogs.
2. To evaluate the response of therapeutic procedures on corneal ulcer.
2. REVIEW OF LITERATURE

Corneal ulcer is an inflammatory condition of the cornea involving loss of its outer layer. It is very common in dogs and is sometimes seen in cats. Causes include self-inflicted, trauma, eyelid abnormalities, thermal and chemical burns, immune mediated, facial paralysis, keratitis, absence of the protective tear film and infection with bacteria, viruses and fungal elements.

2.1 Incidence

Petrick (1996) conducted a survey on 1772 cases of dogs to record the incidence of eye affections and concluded that the most important eye affections were cataract, glaucoma, corneal ulcers, progressive retinal atrophy, iris prolapse, pannus, pigmentation and keratoconjunctivitis sicca.

Kim (2009) concluded in their study that the incidence of corneal ulcers were more in under 3 years of age i.e., 47% followed by age group of 3-6 (28%), 6-9 (14%) and lowest incidence was reported for age group 9-12 years (9%).

Juliet (2011) reported that corneal ulcers are one of the most common ophthalmic diseases seen in dogs caused mostly due to trauma to the eye or may be without any apparent causes.

Paula et al. (2011) studied on various eye affection in 324 boxer dogs out of which 189 (58.33%) were diagnosed with indolent ulcer. Incidence of corneal ulcer was 55.83% in females followed by males 44.17%. Maximum animals were related to age group of 1-12 years. Blepharospasm was noticed in 69.72% of cases followed by red eye (69.60%) and ocular discharge (64.79%).

Ramani et al. (2012) and Ramani et al. (2013) recorded incidence of corneal ulcers in dogs and reported that male animals were more susceptible (60.2%) than female (39.8%). Highest incidence was recorded in Pug (37.26%) followed by Spitz (12.5%), Non Descript (16.7%), Boxer and Labrador (4.94%), Rottweiler, Great Dane and Pekingese (1.24%), Dachshund, Bulldog, Beagle and Cocker Spaniel (0.62%). Age group of 1-3
years showed maximum incidence (50%) followed by 4-7 yrs (29.2 %) and above 8 yrs (20.8 %).

Sale et al. (2013) recorded the incidence, distribution and pattern of ocular affections in dogs and concluded that the incidence was more during summer months in age group of 5-10 years. Maximum incidence was recorded in Spitz (65%) and least in Dalmatian and Beagle (0.12% each). Male animals were found mostly affected (60%). Anatomical categorization of the ocular affections revealed maximum cases were involving lens (34%) followed by cornea (28%), retina (11%), eyelid (9%), conjunctiva (8%), glaucoma (6%), anterior chamber and globe (2% each). Categorisation of the ocular affections revealed highest incidence of cataract (295 cases) followed by corneal ulcer (134), cherry eye (78), progressive retinal atrophy (62), corneal melanosis (49), retinal detachment (34), corneal opacity (24), corneal oedema (24), hypopion (11) and hyphema (6).

Akinrinmade and Ogungbenro (2015) retrospectively studied the incidence of various ocular affections in dogs. Overall incidence of eye affection in dogs was 6.62% with Alsatian breed being the most affected. Majority of ocular affections occurred in dogs less than 5 years of age.

Singh et al. (2015) recorded the incidence in 35 dogs and found that the highest incidences of corneal ulcer was found in Neapolitan mastiff followed by pug and mongrel corneal ulcer affected dogs showed lacrimation blepharospasm and periocular swelling.

2.2 Etiology

Hazra and Palui (2011) stated that traumatic injury was the major cause of corneal ulcer in dogs and reported highest incidences of corneal ulcer in pug (54%), spitz (23%), boxer (12%) and Labrador (11%).

Paula et al. (2011) retrospectively studied the incidence of corneal ulcers in 324 boxer dogs. Trauma was reported in 10 cases as the cause of the wound. Ophthalmological examination at first consultation revealed that the most of the ulcers were unilateral (n=130), however, six animals were having ulcers in both the eyes. Indolent ulcers were more
frequently observed in the right (n=77, 54.23%) than the left eye (n=65, 45.77%) followed by the center of the cornea (n=57, 40.14%), presenting discontinuation of the epithelium (n=49, 34.51%), discontinuation of the epithelium with neovascularization (n=34, 23.94%) or discontinuation of the epithelium and granuloma (n=17, 11.97%).

2.3 Pre-operative ophthalmic evaluation

Gelatt (1985) and Rogers et al. (1986) recommended the use of two-dimensional real-time ultrasonography to diagnose intraocular conditions, when opacity of the anterior segment prohibited examination of deeper structures within the eye. Retinal detachment, intraocular masses, foreign body. Retrobulbar abnormalities could be easily diagnosed by ultrasonography. It was suggested that the use of B-scan ultrasonography have described the ocular and orbital anatomical features in situ.

Gaiddon et al. (1991) measured the corneal curvature and radius of curvature first time and reported mild astigmatism among dogs by ultrasonography.

Hlinomazova and Vlkova (2003) had emphasized estimation of intraocular pressure (IOP) for the diagnosis of underlying glaucoma/uveitis by ultrasonography.

Hamor (2004) conducted a study to determine the effect of fluorescein dye strips for the diagnosis of corneal ulcer in dog to check the size, shape, location and depth of corneal ulcer for the assessment of the severity of ulcer.

Kumar (2008) performed cataract surgery in 12 dogs. They was found that the schirmer tear test ranged between 12 to 20 mm/minute which was within the normal range and none of the dogs was diagnosed for glaucoma.

Singh et al. (2015) recorded the effect of fluorescein stain dye in 35 dogs and reported diffuse corneal uptake of stain. A diffused superficial corneal ulceration was diagnosed by fluorescein dye test. They also observed clinical signs like lacrimation, blepharospasm and periocular swelling.
Tomkowicz et al. (2015) reported that the 2% eye drops or disposable fluorescein dye strips were widely used in both human and veterinary ophthalmology. Fluorescein dye has been used in the diagnosis of corneal ulcers, obstruction of the nasolacrimal duct (Jones test), disorders of the tear film quality (TBUT - tear breakup time) or perforation of the eyeball (Seidel test). It is easy to use, low cost, and allows for quick diagnosis.

2.4 Microbiological examination

Croix (2006) reported the bacterial and fungal corneal ulcers were commonly found in animals. Bacterial culture, fungal staining and sensitivity tests for the diagnosis of bacteria and fungus were performed and effective antibiotics for corneal ulcer treatment were identified.

Prado et al. (2006) reported 19 dogs with corneal ulcer (16 unilateral and three bilateral) for isolation and antimicrobial susceptibility for evaluation of the bacteria. Bacterial growth was observed in 100% of the samples. Gentamicin, ciprofloxacin, chloramphenicol and tobramycin had a high efficacy against all of the isolated bacteria. The results evidenced that 80.7% of the isolates were Gram positive cocci and Gram positive bacilli.

Ramani et al. (2013) reported incidence of corneal ulcers in 24 dogs and performed isolation of bacteria and antibiotic sensitivity test (ABST). The most commonly isolated bacteria from corneal culture were Staphylococcus spp., followed by Escherichia coli and Bacillus spp. The antibiotic sensitivity test revealed that the pathogens were more sensitive to Cefotaxime followed by enrofloxacin, tetracycline, gentamicin, azithromycin and amoxicillin.

2.5 Medicinal therapy

Millichamp et al. (1991) used flurbiprofen pre-operatively to reduce surgically induced intraoperative miosis and attributed this phenomenon may be due to the release of prostaglandin.

Croix (2006) reported that the antibiotics chloramphenicol, tobramycin and ciprofloxacin effectively treated corneal infections and prevented further complications like corneal rupture and loss of vision in dogs.
Combination of chloramphenicol with tobramycin should kill over 99% of bacteria found in corneal infections.

Hvenegaard (2011) reported that indolent ulcers were superficial corneal ulcers secondary to several changes on the corneal surface. They were frequently observed in middle-aged Boxer dogs and treated with 1% atropine, antibiotics, anti-inflammatory drugs and vitamin C. Healing was delayed in dogs administered orally with vitamin C, but the healing process was faster on those dogs that went through corneal debridement and cauterization. It was suggested that debridement/cauterization, administration of proteinase inhibitor eye drops, prophylactic topical antibiotics and oral vitamin C, should be considered as an effective clinical management for indolent ulcers in Boxer dogs.

Gionfriddo (2013) and Sharma et al. (2013) compared moxifloxacin 0.5%, cefazolin sodium 5% and tobramycin sulfate 1.3% eye drops combination in the treatment of moderate bacterial corneal ulcers in 224 human patients. A complete resolution of keratitis (81.8%) was observed in patients affected with coagulase-negative Staphylococcus.

Singh et al. (2015) performed temporary tarsorrhaphy in 5 dogs for the treatment of corneal ulcers along with topical broad-spectrum antibiotics ciprofloxacin and topical NSAIDs ketorolac. Healing took place in 2-3 weeks. All dogs were recovered except one.

2.6 Surgical procedures

Lewin (2000) reported that eight dogs of aged 7 to 20 weeks suffered with corneal ulcer due to entropion they were treated with temporary tarsorrhaphy. The sutures were placed on eyelids margins, so that on gentle tightening the eyelid margins were apposed and prevent the lower eyelid from inverting. The sutures were well tolerated for a period of one week and there was no reduction in vision. Entropion reoccurred after 7 months of surgery due to excessive folding of facial skin. Further suturing with same technique was done and found unsuccessful result so it was concluded that for treatment of entropion, temporary tarsorrhaphy should not be performed.
Bromberg (2002) retrospectively studied the effect of cyanoacrylate tissue adhesive for temporary tarsorrhapy for treatment of refractory superficial corneal ulceration in 17 dogs, one cat, and one rabbit. Little to no sedation was required in the majority of cases, with only topical anesthetic applied prior to debridement and cyanoacrylate tissue adhesive application. The presence of the tissue adhesive caused mild discomfort for several days after application, as reported by the owners. The ulcers healed, and the tissue adhesive sloughed in approximately 3 weeks (± 1 week). Mild neovascularization of the cornea resolved with topical corticosteroids. The use of cyanoacrylate tissue adhesive offers a simple, safe and non-invasive treatment for refractory corneal ulcers.

Cosar et al. (2002) reported the success rate and complications of tarsorrhaphy for the treatment of corneal ulcers. The epithelial defects in 70 (90.9%) of the 77 eyes completely resolved. Overall, the mean duration of signs and symptoms before tarsorrhaphy was 89.8 +/- 27.8 days, and time for healing after tarsorrhaphy was 18.0 +/- 2.0 days. Complications after tarsorrhaphy included trichiasis, adhesion between upper and lower lids after tarsorrhaphy lysis, premature opening of the temporary tarsorrhaphy, pyogenic granuloma and keloid formation of the eyelid was found. It was concluded that tarsorrhaphy was a very effective and safe procedure in the management of nonhealing epithelial defects and other surface problems, with a 90.9% success rate.

Ancheril (2004) and Schoster (2002) performed third eyelid flap surgery in one dog and concluded that third eyelid flaps were an excellent form of protection and splint for the corneal epithelium during healing.

Galera et al. (2004) evaluated third eyelid flap surgery in dog along with topical antibiotic, anti-inflammatory eye drops and 1% atropine ophthalmic ointment and suggested that corneal ulcer healed completely after eight days.

Morgan (2004) performed temporary tarsorrhaphy and third eyelid flap surgery in dogs to treat traumatic corneal ulcer and reported that ulcer was completely healed after few weeks. Both the surgeries were
performed for protection and promotion for healing of corneal ulcer and to decrease photophobia and pain and ulcer was completely healed after 2 to 3 weeks.

Donaldson et al. (2005) performed third eyelid flap surgery along with antibiotic gentamicin and anti-inflammatory flurbiprofen eye drops in dogs suffering with ulcerative keratitis. On 12th post operative day after suture removal the dogs were found to be completely recovered. In few of dogs only mild scar was observed.

James et al. (2006) performed tarsorrhaphy for the treatment of severe ocular surface disorders and cases of ocular exposure. Temporary tarsorrhaphy had been shown to aid in the healing of corneal epithelial defects. A variety of temporary techniques had been suggested that allowed closure for epithelial healing but also allowed access to the eye. The drawstring temporary tarsorrhaphy uses rubber bolsters and 6-0 prolene sutures passed through the eyelid margin. This modification of the temporary tarsorrhaphy allowed for complete closure of the eyelids while providing easy opening and closing. In addition, this technique was easy to perform in almost any setting.

Kim (2009) performed a study of ulcerative keratitis in 32 Dogs. Third eye lid flap surgery was performed in most of the dogs. The superficial corneal ulcers healed within 5-13 days without complications while the deep corneal ulcers took 28-40 days to heal.

Singh et al. (2015) conducted a study on corneal ulcers and other common ophthalmic affection in 35 dogs. Corneal ulcer was confirmed in 5 dogs on basis of gross examination and external ophthalmic stain. Which were successfully managed by temporary tarsorrhaphy along with topical atropine, topical broad-spectrum antibiotic and topical non-steroidal anti-inflammatory drugs (NSAIDs).
3. MATERIAL AND METHODS

3.1 Location and place of work

The research work was carried out in the Department of Veterinary Surgery and Radiology, Teaching Veterinary Clinical Complex (TVCC), College of Veterinary Science and Animal Husbandry, N.D.V.S.U., Jabalpur (M.P.).

3.2 Meteorological data and features of place

Jabalpur is situated at 23.17° latitude and 79.57° East longitudes at 410.87 mean sea level in the southern part of second agro-climatic zone, including Satpura Plateau and Kymore hills. It has a tropical climate having average rainfall of 1241 mm.

3.3 Study period

The study was conducted for a period of nine months from August, 2015 to April, 2016.

3.4 Animals

The study was conducted on twelve clinical cases of corneal ulcer in dogs, presented at Teaching Veterinary Clinical Complex (TVCC), irrespective of age, sex and breed. Dogs suffering with moderate and severe corneal ulcer were included in the present study. The animal having descemetoceles and corneal perforation were excluded.

3.4.1 Screening

Ophthalmic examination and direct ophthalmoscopic examination was done on all the canine cases irrespective of age, sex and breed brought to TVCC during study period showing the problems related to vision Out of which 12 dogs suffering with corneal ulcer were selected for present research work.

3.5 Experimental design

All the dogs irrespective of age, sex and breed will be randomly divided into two equal groups.
Group I (n=6): Six dogs with corneal ulcer were treated with temporary tarsorrhaphy technique along with medicinal treatment.

Group II (n=6): Six dogs with corneal ulcer were treated with third eye lid flap technique along with medicinal treatment.

Table 01: Treatment design

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Group I (n=6)</td>
<td>Temporary tarsorrhaphy technique + medicinal treatment</td>
</tr>
<tr>
<td>2.</td>
<td>Group II (n=6)</td>
<td>Third eye lid flap surgery + medicinal treatment</td>
</tr>
</tbody>
</table>

3.6 Instrumentation

Apart from general surgical pack, a special pack for ophthalmic surgery was prepared having Jaffe tying forceps, Barraquer needle holder, straight scissor eyelid retractor and rubber quills (Plate 01).

3.7 Parameters of the study

3.7.1 Anamnesis

The detailed history of age, breed, sex, hereditary origin, diet and any trauma of the eye was recorded. Systemic illnesses, injuries, previous therapies and any other conditions potentially pertaining to the present problem was also be recorded.

3.7.2 Clinical examination

Rectal temperature (°F), respiration rate (per minute) and pulse rate (per minute) was recorded prior to treatment to judge the health status of the animal. Palpebral mucous membrane was examined for anaemia, icterus etc. Eye was palpated by index finger to check the intra ocular pressure, vision was judged by palpebral reflex and menace (Blink) reflex in addition, epiphora, conjunctivitis, hyphema, foreign body and location of ulcer (axial, paraxial, inferior nasal, inferior temporal, perilimbal) were also recorded on day 0 prior to surgery.
3.7.3 Pre-operative ophthalmic examination

Pre-operative ophthalmic examination was performed on 0 day before starting the treatment which included:

3.7.3.1 Schirmer tear test

It was done with the help of schirmer tear test strip to know the amount of lacrimation being produced from the conjunctival and corneal surfaces (Plate 02).

3.7.3.2 Fluorescein dye test

It was done with the help of fluorescein dye test strip to check the location of ulcer and to measure the size and depth of corneal ulcer (Plate 03).

3.7.3.3 Ophthalmoscopic examination

Direct ophthalmoscopic examination was performed with the help of direct ophthalmoscope to check the fundus and intraocular pathology of the eye (Plate 04).

3.7.3.4 Ultrasonographic examination

Ultrasonographic examination was done by using Philips HD7 XE ultrasound machine to check the intraocular pathology and other abnormalities of the eye (Plate 04).

3.7.4 Microbiological examination

Swab was collected aseptically from corneal ulcer then keep in to the transport media. Gram's staining and Potassium hydroxide (KOH) staining performed for bacteria and fungus respectively. Antibiotic sensitivity test was also done to identified most sensitive antibiotic for bacterial infection (Plate 05).

3.7.4.1 Gram’s staining (Tille, 2014)

- A clean, dry, grease-free glass slide was taken and using a glass marking pencil a circle equivalent to Rs 5 coin was drawn on it.
- A drop of water was added inside the circle on the slide.
- Using a sterile loop a small amount of growth was transferred from a 18-24 hour culture plate and mixed thoroughly with the drop of water to make a uniform smear.
- The smear was air dried and was heat fixed.
- The slide was flooded with crystal violet stain for 1 minute. The slide was washed with water.
- Gram’s iodine was added for 30 seconds and was washed with water.
- The slide was de-stained using 95% ethyl alcohol drop by drop to slide until ethyl alcohol running from the slide turned clear
- The slide was flooded with safranin as counter-stain for 1 minute.
- The slide was washed with water and air dried.
- The slide was observed under 100X oil-immersion lens under bright field microscope for the Gram’s reaction morphology and cellular arrangement.

3.7.4.2 Direct KOH (10%) mount:

- A clean, dry, grease-free glass slide was taken
- Make a direct smear by the swab just after collection of sample.
- A drop of 10% KOH was added on the slide and mixed properly.
- The slide was observed under 40X lens under bright field microscope for the fungal hyphae.

3.7.4.3 Kirby-Bauer disk diffusion method for antimicrobial susceptibility test (CLSI, 2013)

Preparation of Mueller Hinton agar plate - Mueller Hinton agar was prepared from a commercially available dehydrated base according to the manufacturer instructions.
Mueller Hinton dehydrated base agar (HiMedia) was dissolved in Type II water @ 38 grams /liter. The agar was autoclaved and was kept in 50° C water-bath.

In a vertical laminar airflow about 25 ml of the sterile freshly prepared and cooled medium was poured on pre-sterilized plastic flat-bottomed optically transparent 90 mm petri plates (Tarsons) so as to have a depth of 4-5 mm.

The agar medium was allowed to cool to room temperature and unless the plate was used the same day, the plate were stored in a refrigerator (2 – 8 mm).

3.7.4.4 Kirby-Bauer disk diffusion method

A sterile non-toxic cotton swab on a wooden applicator (HiMedia) was soaked by dipping into the standardized inoculum. The soaked swab was rotated firmly against the upper inside wall of the express excess fluid.

The entire agar surface of the Mueller Hinton agar was streaked three times by turning the plate at 60° angle between each streaking.

The inoculum was allowed to dry for 5-10 minutes with lid in place.

Using the aseptic technique the antimicrobial discs were applied to the agar plates at least 24 mm apart with the help of template under the MH agar plate.

The plate were incubated at 35° C for 24 hours.

The zone of inhibition were measured using a transparent scale and diameters of the zone to the nearest millimeter were recorded.

3.7.5 Pre-operative therapy

Pre-operative medicinal treatment was started five days before surgery.
3.7.5.1 Systemic treatment

Tab. moxifloxacin hydrochloride @ 5-10 mg/kg b.wt. orally od, Inj. meloxicam @ 0.2-0.3 mg/kg b.wt. I/M od for 3 days, Multi vitamins, minerals and ginseng capsules od. (Plate 06).

3.7.5.2 Local treatment

Eye drop moxifloxacin (0.5%) one to two drops qid, Eye drop flurbiprofen (0.03%) two drops qid, atropine sulphate eye ointment (1%) topically bid. Eye drop hydroxypropyl methylcellulose (0.1%) two drops (Plate 07).

3.7.6 Preparation of the animal dogs

All the dogs were kept off feed for 12 hours prior to surgery. The whole area around the eye was scrubbed properly followed by local application of povidone iodine solution (5%).

3.7.6.1 Anaesthesia

The surgical procedure was performed under adequate general anaesthesia. In all the animals of Group I and II. General anaesthesia was induced using, Inj. atropine sulphate @0.04 mg/kg b.wt intramuscularly, after 5 minutes Inj. xylazine hydrochloride @1.5 mg/kg b.wt intramuscularly and after 10 minute Inj. ketamine hydrochloride @6 mg/kg b.wt intramuscularly. Maintenance of anaesthesia was done by using inj. ketamine hydrochloride intravenously as per the requirement. Topical anaesthesia of eye was achieved by applying a gauze soaked in Lignocaine Hydrochloride (4%) for 5 minute (Plate 08).

1. Tab. Moxifloxacin hydrochloride- Torrent pharmaceuticals Ltd., Sikkim, India.
2. Inj. Meloxicam – Intas pharmaceuticals Ltd., Ahmedabad, India.
4. Eye drop Moxifloxacin hydrochloride- Cipla pharmaceutical Ltd., Mumbai, India.
5. Eye drop Flurbiprofen sodium- Allergan India Pvt. Ltd., Dhar, M.P. India.
6. Oint. Atropine sulphate- Biomedica international, Punjab, India.
7. Eye drop hydroxypropyl methylcellulose- Novartis India Ltd., Mumbai, India.
3.7.7 Operative procedure

3.7.7.1 Temporary tarsorrhaphy technique

For temporary tarsorrhaphy 4-0 silk was taken and needle passed through the full depth of upper eyelid margin. The needle was taken out through upper palpebral conjunctiva and then it was passed through lower palpebral conjunctiva upto lower eyelid margin. A small polyethylene tube quill was passed through the suture to prevent cutting and embedding of suture. (Plate 09a and 09b) There after this process is reversed and knot was tight on upper eyelid margin after passing another quill. Sutures were removed after 15 days (Lewin, 2000).

3.7.7.2 Third eyelid flap technique

For third eyelid flap technique 4-0 silk was taken and passed through the full depth of upper eyelid margin towards medial canthus. The needle was taken out through upper palpebral conjunctiva and then it was passed through the partial thickness of third eyelid. There after third eye lid was pulled upto extent when it completely covered the corneal surface. (Plate 10a and 10b). The needle then passed through the palpebral conjunctiva of upper eyelid towards lateral canthus and needle was taken out through the upper eyelid margin. A small polyethylene tube quill was passed through the suture to prevent cutting and embedding of suture. Then suture was tighten. Suture was opened after 15 days (Morgan, 2004).

3.7.8 Post operative care

Tab. moxifloxacin hydrochloride @ 5-10 mg/kg b.wt. once daily orally for 5 days, meloxicam @ 0.2-0.3 mg/kg b.wt. intramuscular once daily for 3 days, multi vitamins, minerals and ginseng tablets orally for 15 days. In addition, eye drop moxifloxacin (0.5%) one to two drops four times a day for 15 to 30 days, eye drop flurbiprofen (0.03%) two drops four times a day for 7 to 15 days, atropine sulphate eye ointment (1%) topically two times daily for 5 days, eye drop hydroxypropyl methylcellulose (0.1%) two drops four times a day for 15 days.
3.7.9 Post operative grading of corneal ulcer

Post operative grading of corneal ulcer was done as per score card given by Harrison (1975). Healing was recorded on day 0 and on 15th, 30th, 45th and 60th day post operatively (Table 02).

Table 02: Post-operative grading of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Features</th>
<th>Grading of corneal ulcer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>1.</td>
<td>Size</td>
<td>&lt;2mm</td>
</tr>
<tr>
<td>2.</td>
<td>Depth of ulcer</td>
<td>&lt;20%</td>
</tr>
<tr>
<td>3.</td>
<td>Stromal infiltrate</td>
<td>Dense Superficial</td>
</tr>
<tr>
<td></td>
<td>- Density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Extent</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Scleral involvement</td>
<td>-</td>
</tr>
</tbody>
</table>

3.7.10 Haemato-Biochemical Estimations

Approximately 5 ml of blood was collected aseptically from cephalic veins or saphenous vein in vacutainer containing EDTA on 0 day before starting the treatment for estimation of haematological and biochemical parameter.

The haematological parameters were estimated manually as described by Chauhan (2003), while the biochemical parameters were estimated by semi-automatic analyser (ERBA) using their respective commercially available kits.

3.7.10.1 Haematological parameters

- Haemoglobin (gm/dl)
- Total leukocyte count (x10^3/μl)
- Differential leukocyte count (%)

3.7.10.2 Biochemical parameters:

- Blood Glucose (mg/dl)
3.7.11 Post treatment evaluation of corneal ulcer

Eyes was evaluated on 0 day before treatment and on 15th, 30th, 45th and 60th day after treatment for healing of corneal ulcer and complication was also be recorded.

3.8 Statistical analysis

Qualitative data obtained was evaluated by visual analog score and arbitrary score card.

3.9 Collaboration with other department

Necessary help was taken from Teaching Veterinary Clinical Complex (TVCC), Department of Veterinary Microbiology, Department of Veterinary Anatomy and College of Veterinary Science and Animal Husbandry, N.D.V.S.U., Jabalpur as and when required.
4. RESULTS

After cataract corneal ulcer has second highest incidence and conventional treatment of corneal ulcer such as cauterization and medication is not much rewarding thus the present investigation was undertaken to study the incidence of various eye affections in dogs and to evaluate the response of surgical procedures along with newer medication for the treatment of corneal ulcer.

4.1 Incidence

Total 8760 cases of dogs registered at TVCC were screened during the period of 9 months (August, 2015 to April, 2016). Out of these 3872 (44.20%) cases were referred to Department of Veterinary Surgery and Radiology, in which 122 (1.39%) dogs were suffering with various eye affections. During the study period total 16 (0.18%) dogs were found suffering with corneal ulcer (Table 03).

Table 03: Incidence of eye affections and corneal ulcer in dogs

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Detail of cases</th>
<th>Number of cases</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cases registered at Teaching Veterinary Clinical Complex (TVCC)</td>
<td>8760</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Cases referred to the dept. of Veterinary Surgery and Radiology</td>
<td>3872</td>
<td>44.20</td>
</tr>
<tr>
<td>3.</td>
<td>Cases of various eye affections in dogs</td>
<td>122</td>
<td>1.39</td>
</tr>
<tr>
<td>4.</td>
<td>Cases of corneal ulcer in dogs</td>
<td>16</td>
<td>0.18</td>
</tr>
</tbody>
</table>

4.1.2 Occurrence of eye affections

The data collected are presented in table 04, figure 01 and plate 11(a) and 11(b). Majority of the animals were affected with cataract (38.52%), followed by corneal ulcer (13.11%). The occurrence of rest of the eye affections was less.
Table 04: Occurrence of eye affections

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of various eye affection</th>
<th>Total cases</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cataract</td>
<td>47</td>
<td>38.52</td>
</tr>
<tr>
<td>2.</td>
<td>Corneal ulcer</td>
<td>16</td>
<td>13.11</td>
</tr>
<tr>
<td>3.</td>
<td>Protrusion of eye ball</td>
<td>09</td>
<td>07.45</td>
</tr>
<tr>
<td>4.</td>
<td>Accidental injury</td>
<td>07</td>
<td>05.81</td>
</tr>
<tr>
<td>5.</td>
<td>Wart</td>
<td>06</td>
<td>04.92</td>
</tr>
<tr>
<td>6.</td>
<td>Glaucoma</td>
<td>06</td>
<td>04.92</td>
</tr>
<tr>
<td>7.</td>
<td>Wound (Lacerated + Maggoted)</td>
<td>05</td>
<td>04.09</td>
</tr>
<tr>
<td>8.</td>
<td>Conjunctivitis</td>
<td>05</td>
<td>04.09</td>
</tr>
<tr>
<td>9.</td>
<td>Corneal opacity</td>
<td>05</td>
<td>04.09</td>
</tr>
<tr>
<td>10.</td>
<td>Fungal infection</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>11.</td>
<td>Conjunctivitis + Corneal opacity</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>12.</td>
<td>Corneal dystrophy</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>13.</td>
<td>Third eyelid protrusion</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>14.</td>
<td>Corneal opacity + wart</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>15.</td>
<td>Completely blind</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>16.</td>
<td>Glaucoma + Corneal opacity</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>17.</td>
<td>Impaired Vision</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>18.</td>
<td>Entropion</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>19.</td>
<td>Hyalitis</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>20.</td>
<td>Epiphora</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>21.</td>
<td>Cherry eye</td>
<td>01</td>
<td>00.81</td>
</tr>
</tbody>
</table>
4.1.3 Breed wise incidence of eye affections

The data collected are presented in table 05 and figure 02. Majority of animals were non-descript (38.62%), followed by Pomeranian (31.97%) and in rest of the breeds incidence of eye affection was low.

Table 05: Breed wise incidence of eye affections

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the breed</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Non descript</td>
<td>47</td>
<td>38.62</td>
</tr>
<tr>
<td>2.</td>
<td>Pomeranian</td>
<td>39</td>
<td>31.97</td>
</tr>
<tr>
<td>3.</td>
<td>Labrador</td>
<td>17</td>
<td>13.93</td>
</tr>
<tr>
<td>4.</td>
<td>German Shepherd</td>
<td>06</td>
<td>04.91</td>
</tr>
<tr>
<td>5.</td>
<td>Pug</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>6.</td>
<td>Great Dane</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>7.</td>
<td>Boxer</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>8.</td>
<td>Lhasa Apso</td>
<td>02</td>
<td>01.63</td>
</tr>
<tr>
<td>9.</td>
<td>Bullmastiff</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>10.</td>
<td>Cocker Spaniel</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>11.</td>
<td>Rottweiler</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>12.</td>
<td>Dalmatian</td>
<td>01</td>
<td>00.81</td>
</tr>
<tr>
<td>13.</td>
<td>French Mastiff</td>
<td>01</td>
<td>00.81</td>
</tr>
</tbody>
</table>

4.1.4 Age wise incidence of eye affections

The data collected are presented in table 06 and figure 03. Majority of animals were between 6 to 10 years (47.54%) of age, followed by 11 to 15 years (31.96%) and 0 to 5 years (20.49%). Incidence was low in young dogs and mostly traumatic injuries and protrusion of eye ball were observed in this age group.
Table 06: Age wise incidence of eye affections

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Age (Years)</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0 - 5</td>
<td>25</td>
<td>20.49</td>
</tr>
<tr>
<td>2.</td>
<td>6 - 10</td>
<td>58</td>
<td>47.54</td>
</tr>
<tr>
<td>3.</td>
<td>11 -15</td>
<td>39</td>
<td>31.96</td>
</tr>
</tbody>
</table>

4.1.5 Sex wise incidence of eye affections

The data collected are presented in table 07 and figure 04. Majority of animals were male (70.49%) whereas incidence of eye affection was observed less in female animals (29.50%).

Table 07: Sex wise incidence of eye affections

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Sex</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Male</td>
<td>86</td>
<td>70.50</td>
</tr>
<tr>
<td>2.</td>
<td>Female</td>
<td>36</td>
<td>29.50</td>
</tr>
</tbody>
</table>

Out of 16 cases of corneal ulcer only 12 cases were selected for the present study, suffering with moderate and severe corneal ulcer. Remaining 4 cases were suffering with severe corneal ulcer along with descemetoceles and corneal perforation which, were excluded from the present study.

Twelve dogs were randomly divided into two equal groups, so that in both the groups moderate and severe ulcers may fall. In all the dogs detailed anamnesis clinical and ophthalmoscopic examinations were carried out to evaluate corneal ulcer.
4.2 Anamnesis and clinical observation

4.2.1 Age wise distribution

Age of the animals included in this study has been shown in table 08 and figure 05. In all the dogs, 8 dogs were between 6-10 years (66.67%) while 2 dogs were between 0-5 years (16.66%) and rest of the 2 were between 11-15 years (16.66%).

Table 08: Age wise distribution of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Age (Years)</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0 – 5</td>
<td>2</td>
<td>16.66</td>
</tr>
<tr>
<td>2.</td>
<td>6 – 10</td>
<td>8</td>
<td>66.67</td>
</tr>
<tr>
<td>3.</td>
<td>11 -15</td>
<td>2</td>
<td>16.66</td>
</tr>
</tbody>
</table>

4.2.2 Sex wise distribution

The sex ratio of the animals has been presented in table 09 and figure 06. Total 66.66% male and rest of 33.33% female were suffering with corneal ulcers.

Table 09: Sex wise distribution of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Sex</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Male</td>
<td>8</td>
<td>66.66</td>
</tr>
<tr>
<td>2.</td>
<td>Female</td>
<td>4</td>
<td>33.33</td>
</tr>
</tbody>
</table>

4.2.3 Breed wise distribution

The data collected are presented in table 10 and figure 07. In all the dogs, 7 cases of corneal ulcer were recorded in Non descript breed (58.33%), followed by Pomeranian (25%) and remaining was Pug and Labrador 8.33% each.
Table 10: Breed wise distribution of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the breed</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Non descript</td>
<td>7</td>
<td>58.33</td>
</tr>
<tr>
<td>2.</td>
<td>Pomeranian</td>
<td>3</td>
<td>25.00</td>
</tr>
<tr>
<td>3.</td>
<td>Pug</td>
<td>1</td>
<td>08.33</td>
</tr>
<tr>
<td>4.</td>
<td>Labrador</td>
<td>1</td>
<td>08.33</td>
</tr>
</tbody>
</table>

4.2.4 Probable etiology

Etiology of the corneal ulcer formation in the cases has been mentioned in table 11 and figure 08. Self trauma by pawing (66.66%) emerged to be the major cause of corneal ulcer, whereas a corneal aberration after the automobile accident (25%) and keratoconjunctivitis sicca (8.33%) was also the causes of corneal ulcer.

Table 11: Etiology of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Etiology</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Self trauma</td>
<td>8</td>
<td>66.66</td>
</tr>
<tr>
<td>2.</td>
<td>Corneal aberration</td>
<td>3</td>
<td>25.00</td>
</tr>
<tr>
<td>3.</td>
<td>Keratoconjunctivitis sicca</td>
<td>1</td>
<td>08.33</td>
</tr>
</tbody>
</table>

4.2.5 Duration of corneal ulcer formation

Duration of the corneal ulcer formation in the cases has been mentioned in table 12 and figure 09. The course of illness as revealed by the history indicated that maximum course of illness was between 10 to 15 days i.e. in 7 cases (58.33%), followed by a period of 5 to 10 days i.e. in 3 cases (25%) and lastly in 2 cases about 1 to 2 days (16.66%).
### Table 12: Duration of corneal ulcer formation

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Duration (Days)</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10 – 15</td>
<td>7</td>
<td>58.33</td>
</tr>
<tr>
<td>2.</td>
<td>5 – 10</td>
<td>3</td>
<td>25.00</td>
</tr>
<tr>
<td>3.</td>
<td>1 – 2</td>
<td>2</td>
<td>16.66</td>
</tr>
</tbody>
</table>

#### 4.2.6 Feeding habit of dogs

The data collected in this regard has been presented in table 13 and figure 10. In all the dogs, 8 (66.67%) were non-vegetarian and rest of the 4 cases (33.33%) were vegetarian in dietary nature. The body weight of all the twelve dogs suffering with corneal ulcer ranged between 8 to 22 kg.

### Table 13: Feeding habit of dogs

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Dietary management</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Non-vegetarian</td>
<td>8</td>
<td>66.66</td>
</tr>
<tr>
<td>2.</td>
<td>Vegetarian</td>
<td>4</td>
<td>33.33</td>
</tr>
</tbody>
</table>

#### 4.3 Clinical examination

Average Rectal temperature (°F), respiration rate (per minute) and pulse rate (per minute) were recorded at 0 day, before the start of study to check the health status of dogs. In all the twelve dogs rectal temperature, respiration rate and pulse rate ranged between 101.6 to 102.6 °F, 20 to 26 per minute and 91 to 96 per minute respectively, which were within in the normal physiological limits. All the dogs had showing normal pink colour palpebral mucous membrane. Anorexia and dehydration was not observed in any of the dog (Appendix 01).

Total leukocyte count ranged between 7 to 9 thousand/µl haemoglobin between 13 to 16 g/dl and differential leukocyte count within normal physiological range. In all the dogs blood glucose level ranged between 102 mg/dl to 110 mg/dl which was within the normal reference range (Appendix 01).
4.4 Pre-operative ophthalmic examination

In gross examination majority of the dogs showed mild to moderate lacrimation, congestion and mild corneal opacity. Intraocular pressure was normal and none of the dog was diagnosed for glaucoma with corneal ulcer. All the dogs responded to menace reflex, direct pupillary light reflex and dazzle reflex (Plate 12 and Appendix 02).

4.4.1 Schirmer tear test

In all the dogs schirmer tear test was measured which ranged between 22 to 26 mm/min which was higher than the normal limits. It indicated higher lacrimation in all the cases except in one dog where it was measured 4 mm/min, which was lower than the normal range and dogs were diagnosed for dry eye condition i.e. Keratoconjunctivitis sicca (Plate 13 and Appendix 02).

4.4.2 Ophthalmoscopic examination

In all the dogs suffering with corneal ulcer direct ophthalmoscopic examination was performed. Fundus was visualized at 0 to -2 dioptors. At -1 dioptor both tepatal and non-tapetal parts of fundus was visualized. Non-tapetal part was observed brownish and reddish in colour and tapetal part yellow, green and orange in colour in all the dogs. Negative diopters focuses more posterior and positive diopters focuses more anterior part of the eye ball by direct ophthalmoscope.

4.4.3 Fluorescein dye test

In all the cases fluorescein dye measured different location of corneal ulcer along with their size. The stain adheres to any areas where the epithelium of cornea is missing and where the underlying layer, collagen or stroma has been exposed. It gives fluorescent green stain around the border of the cornel ulcer for better visualization of ulcer (Plate 13 and Appendix 02).
4.4.4 Ultrasonographic examination

Ultrasonographic examination was performed to evaluate deeper structures of eye. Aqueous humour, lens and vitreous humour appeared anechoic black in colour. Lens capsule appeared faint white line and retina visualized as hyperechoic. In all the cases no internal ocular pathology such as vitritis, retinal detachment, vitreal foreign body and cataract etc. was observed (Plate 13).

4.4.5 Location of corneal ulcer

The data collected during the study period are presented in table 14 and plate 14. Out of all selected dogs majority of the corneal ulcers were located in inferior temporal (33.33%) followed by axial (16.67%), peripheral (16.67%) and inferior nasal (16.67%) positions. In few dogs paraxial and perilimbal location was also observed (Appendix 02).

Table 14: Location of corneal ulcer

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Location of ulcer</th>
<th>Number of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inferior temporal</td>
<td>4</td>
<td>33.33</td>
</tr>
<tr>
<td>2.</td>
<td>Inferior nasal</td>
<td>2</td>
<td>16.67</td>
</tr>
<tr>
<td>3.</td>
<td>Peripheral</td>
<td>2</td>
<td>16.67</td>
</tr>
<tr>
<td>4.</td>
<td>Axial</td>
<td>2</td>
<td>16.67</td>
</tr>
<tr>
<td>5.</td>
<td>Paraxial</td>
<td>1</td>
<td>08.33</td>
</tr>
<tr>
<td>6.</td>
<td>Perilimbal</td>
<td>1</td>
<td>08.33</td>
</tr>
</tbody>
</table>

4.4.6 Size of corneal ulcer

Size of corneal ulcer was measured in mm in all the dogs ranged between 2 mm to 5 mm and according to arbitrary score card given by Harrison (1975), majority of the dogs were suffering from moderate corneal ulcer (83.33%) and less cases (16.66%) were reported for severe corneal ulcer (Plate 15 and Appendix 02).
4.4.7 Depth of ulcer

According to arbitrary score card given by Harrison (1975), majority of the dogs were suffering with moderate corneal ulcer and there was no involvement of the stromal layer of the cornea, while less cases were reported for severe corneal ulcer, where depth extended upto mid stromal layer of cornea (Appendix 02).

4.5 Pre-operative microbiological examination

Pre-operative microbiological examination was performed on 0 day before start of treatment in all the dogs of both groups.

4.5.1 Bacterial infection

For pre-operative microbial examination of corneal ulcer in dogs the data was collected and presented in Table 15, Plate 16 and Appendix 03. All the dogs were suffering with bacterial infection, 7 (58.33%) dogs were positive for Gram +ve bacteria, out of which 2 dogs were showing Gram +ve cocci in short chains and 5 dogs showed Gram +ve rods in short and long chains.

One (8.33%) dog was positive for Gram –ve coco bacilli and 4 (33.33%) dogs were showing mixed bacterial infection.

Table 15: Pre-operative bacterial infection in case of corneal ulcer in dogs

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Type of infection</th>
<th>No. of dogs</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gram +ve</td>
<td>7</td>
<td>58.33</td>
</tr>
<tr>
<td>2.</td>
<td>Gram –ve</td>
<td>1</td>
<td>08.33</td>
</tr>
<tr>
<td>3.</td>
<td>Mixed infection</td>
<td>4</td>
<td>33.33</td>
</tr>
</tbody>
</table>

4.5.2 Fungal infection

Ocular corneal swab was taken on the glass slide and then mounted with 10% KOH solution. Out of 12 dogs, 3 (25%) were showing septate and 2 (16.66%) cases were showing non septate hyphae, they were indicative for fungal infection. Thus total 5 dogs were showing mixed infection (Both fungal and bacterial) which account 41.66% (Plate 16 and Appendix 03).
4.6 Pre-operative antibiotic sensitivity test

Pre-operative antibiotic sensitivity test was performed on 0 day in all the 12 dogs. Out of 12 dogs, 7 (58.33%) dogs were sensitive, 4 (33.33%) dogs intermediate and 1 (8.33%) dog was resistant for moxifloxacin (Plate 17 and Appendix 04).

In rest of the antibiotic discs, cefoperazone, amikacin and gentamicin also showed sensitivity towards the bacterial infection.

4.7 Pre-operative therapy

Pre-operative medicinal treatment was started five days before surgery, which include antibiotic, moxifloxacin hydrochloride @ 5-10 mg/kg BW once daily orally, analgesic, meloxicam @ 0.2-0.3 mg/kg BW intramuscular once daily and multi vitamin, minerals and ginseng tablets one tablet orally once daily. In addition, local eye drop moxifloxacin (0.5%) one to two drops four times a day, NSAID eye drop flurbiprofen (0.03%) two drops four times a day, antispasmodic atropine sulphate eye ointment (1%) topically two times daily and in dry eye condition tear substitute eye drop containing hydroxypropyl methylcellulose (0.1%) two drops four times a day were also instilled. One case which showed resistant to moxifloxacin was switched over to eye drop gentamicin 1 to 2 drops qid for 15 days. Five cases were showing fungal infection also in these animals eye drop was also started.

4.7.1 Effect of medication in both the groups

In all the cases after systemic and local infiltration of antibiotics and anti-inflammatory medication the infection, lacrimation and congestion started to reduce. On 5th day no lacrimation and congestion was observed however the size of corneal ulcer was not reduced in any of the case. After 5 days of medication temporary tarsorrhaphy in group I and third eye lid flap surgery was performed in group II cases.

4.8 Operative studies

4.8.1 Induction of anaesthesia

The induction of general anaesthesia was smooth in all the dogs of Group I and II using inj. atropine sulphate @0.04 mg/kg b.wt
intramuscularly, after 5 minutes lnj. xylazine hydrochloride @1.5 mg/kg b.wt intramuscularly and after 10 minute lnj. ketamine hydrochloride @6 mg/kg b.wt intramuscularly. Maintenance of anaesthesia was done by using lnj. ketamine hydrochloride intravenously as per the requirement. Topical anaesthesia of eye was achieved by applying a gauze soaked in lignocaine hydrochloride (4%) for 5 minute.

This anaesthetic protocol was observed to be satisfactory for all the dogs of group I and II. Analgesia, muscle relaxation, corneal and palpebral desensitization was noticed to be adequate for the procedure and recovery time was not prolonged.

4.8.2 Surgical procedure

Temporary tarsorrhaphy technique in Group I and third eyelid flap technique in Group II was performed by standard techniques as described in material and methods. Surgical procedure was completed in 7 to 10 minutes in both the groups and no considerable difference in surgical time was recorded. In both the groups there were no complications during the surgery in any of the cases.

4.9 Post operative care

Tab. moxifloxacin hydrochloride @ 5-10 mg/kg b.wt. once daily orally for 7 days, meloxicam @ 0.2-0.3 mg/kg b.wt. intramuscular once daily for 3 days, multi vitamins, minerals and ginseng tablets orally for 15 days. In addition, eye drop moxifloxacin (0.5%) one to two drops four times a day for 15 to 30 days, eye drop flurbiprofen (0.03%) two drops four times a day for 15 days, atropine sulphate eye ointment (1%) topically two times daily for 5 days, eye drop hydroxypropyl methylcellulose (0.1%) two drops four times a day for 15 days.

Instillation of eye drops was found easier in group I temporary tarsorrhaphy as, a small slit like gap was present between upper and lower lid margin and and eye drops spread homogenously over the cornea. In contrary in group II animals, where third eyelid flap was made, approach upto cornea
was difficult and spread of eye drops over the cornea was not homogenous
and most of the drops came out through the lateral canthus.

4.10 **Assessment of the healing of corneal ulcer**

4.10.1 **Post-operative grading of corneal ulcer**

The data collected are presented in appendix 5. Out of 12 cases, size of corneal ulcer was reduced in 10 dogs remaining 2 dogs also showed sufficient healing and scar was present on 15th post-operative day. On 30th post-operative day corneal ulcer was completely healed in all the dogs and scar was present in all the dogs except one case. On 45th day 50% dogs of group I recovered completely and transparency of cornea was maintained, whereas rest of 50% dogs showed slight abraded area / scar at the point of ulcer. In group II complete healing without scar formation was observed in 33.33% cases and scar was present in 66.66% cases. On 60th day in most of the dogs scar was not observed (Plate 18a and Plate 18b).

4.11 **Post operative clinical observation and Complications**

4.11.1 **Ocular discharge**

In all the dogs of both the group mild ocular discharge was observed upto 4th to 5th post operative day, thereafter no ocular discharge was observed upto suture removal on 15th postoperative day (Plate 19).

4.11.2 **Eyelid margins swelling**

In two dogs of group I mild swelling of eyelid margin was observed upto 5th post operative day however in group II dogs swelling was not observed (Plate 19).

4.11.3 **Loosening and disruption of suture**

In one dog of group I slight loosening of suture was observed on 3rd post operative day, while in one dog of group II disruption of third eyelid suture and in rest of the animals congestion and swelling of 3rd eyelid at the suture line was observed (Plate 19).
No complications was observed in Group I and II on 30th, 45th and 60th post operative day. Corneal ulcer completely healed in (66.66%) and (50%) dogs in group I and II respectively on 60th day. Scar was present in only few severe cases. Reoccurrence was not observed in any of the dogs of group I and II on 60th post operative day.

4.11.4 Inflammation of third eyelid

In one dog of group II moderate inflammation of third eyelid was observed on 4th post operative day (Plate 19).

4.11.5 Uneasiness and discomfort

Majority of the dogs was feeling uneasiness and discomfort because of wearing of bandaging and Elizabethan collar after the surgery.

4.11.6 Continuous scratching by paw

Majority of the dogs showed continuous scratching by paw in both the group. It caused disruption of third eyelid suture, loosening of suture and swelling in the eyelid margins in few dogs of both the groups.
5. DISCUSSION

The present study was conducted on 12 dogs irrespective of age, sex and breed. All the animals were having corneal ulcer at different location and size. Preoperative ophthalmic and haemato-biochemical examination and pre-operative medicinal treatment were started on day 0. Medicinal treatment was continued upto 15 to 30 post-operative day. Examination of eye was conducted at preoperatively and on 15th, 30th, 45th and 60th day to monitor the progress of healing of corneal ulcer after surgery. Healing of corneal ulcer was judged on the basis of the score card given by Harrison (1975).

5.1 Incidence

The incidence of various eye affections in dogs was recorded as 1.39% of the total cases of dogs presented at TVCC during the study period, whereas the incidence of corneal ulcer in dogs was calculated to be 0.18%. Collins et al. (1995) and Deuri et al. (2012) performed a study over dogs and reported that incidence of various eye affections was 5.82 %. However, Akinrinmade and Ogungbenro (2015) have reported an incidence of 4.26% of various eye affections which, was little higher than the present study. Less incidence recorded in the present study may be due to the fact that most of the dogs were maintained on balance diet by their owners. Another reason may include less registration of cases of eye affection at TVCC.

5.1.1 Occurrence of eye affections

In the present study, majority of the dogs were suffering with cataract (38.52%), followed by corneal ulcer (13.11%), protrusion of eye ball (7.45%), wart (4.92%) and glaucoma (4.92%) etc. These findings were in consonance with the findings of Petrick (1996) and Juliet (2011). Contrary to this Sellamani (2008) found an incidence of 18.20% of cataract in dogs, whereas Ramani et al. (2013) reported that 23.12% dogs were having cataract.

This discrepancies in findings may be attributed to fact that non-descript dogs are popular in India and reared maximum by the middle class
peoples especially in the urban areas as they are more resistant to diseases and require least maintenance as companion animals. This fact could be the contributing factor for the result of present study.

5.1.2 Breed

The majority of the dogs suffering from a various eye affection in this study were non-descript (38.62%), followed by Pomeranian (31.97%), Labrador (13.93%), German-shepherd (4.91%) etc. In contrary to this, higher incidence was observed by Deuri et al. (2012) in German Spitz (38.46%), Ramani et al. (2013) in Pug (37.36%) and Sale et al. (2013) in Spitz (65%). In the present study this indifference in findings may be due to higher population of non-descript dogs in around Jabalpur because it an urban area and higher population of different pure breeds were not present.

5.1.3 Age

In the present study, majority of animals were between 6 to 10 years (47.54%) of age, followed by 11 to 15 years (31.96%) and 0 to 5 years (20.49%). Sale et al. (2013) corroborated this finding and found highest incidence in 5 to 10 years (55%) old dogs. Contrary to this, Deuri, et al. (2012) reported higher incidence in dogs above 8 years (47.25%) of age. Akinrinmade and Ogungbenro (2015) observed majority of ocular affections occurred in dogs less than 5 years (75%) of age.

This finding can be explained by the fact that as the age of the dog progresses regeneration of the epithelium gets slowed down thus, increases chance of incidence of various eye affections.

5.1.4 Sex

During the present study 70.49% of the animals included were male while only 29.50% were female. This finding was similar to the finding of Rajasekaran (2007), Deuri et al. (2012), Ramani et al. (2013) and Sale et al. (2013) who reported higher incidence in male dogs.
Higher incidence of male dogs may be due to its more population and aggressive behaviour which causes increase the risk of trauma to the eye.

5.2 Anamnesis

5.2.1 Age

In the present study, 8 dogs between 6-10 years (66.67%) were suffering with corneal ulcer while, 2 dogs were between 0-5 years (16.66%) and rest of the 2 were between 11-15 years (16.66%). The observation of Moore (2003) were in consonance to this finding that, the incidence of corneal ulcer was high in middle aged dogs with a mean age of 8.2 year. Wilkie and Whittaker (1997) reported that older dogs were mostly affected whereas Ramani et al. (2012) reported that dogs in the age group of 3 month to 3 year had the highest incidence of corneal ulcers (63.35%).

Higher incidence in middle aged dogs can be explained by the fact that when the age of the dog progresses it may decreases the tear formation and suppress various functions of the eye, besides as the age increased the regeneration power of ocular tissue reduced.

5.2.2 Sex

During the present study higher incidence of eye affection were observed in male (66.66%) as compared to female (33.33%). These findings were in harmony with the findings of Moore (2003) and Ramani et al. (2012) who reported higher incidence of ocular diseases in males as compared to female which was 54.67% in male, and 45.335% in female and 60.2% in male, 39.8 % in female dogs respectively. Whereas, Wilkie and Whittaker (1997) reported that there was no sex predisposition in dogs affected by corneal ulcer.

These finding can be attributed to the fact that male sex is always preferred as pet by majority of pet owner’s therefore may be the population of male dogs registered at TVCC was more. This may also be due to aggressive behaviour of male dogs which increase risk of trauma.
5.2.3 Breed

Breed wise incidence of eye affection was recorded during the present study it was found that the majority of the Non-descript breed (58.33%) were suffering with corneal ulcer, followed by Pomeranian (25%) and remaining were Pug and Labrador 8.33% each.

In contrary to this Moore (2003) reported that corneal ulceration was observed in over 45 different breeds of dogs with Boxer being the most common breed with 24.56% incidence, followed by mixed breed 11.03%, but a high number of cases were also occurred in Poodles, Golden retrievers, Corgie, Labradors Springer spaniel and GSD. Weiner (2002) found higher incidence of corneal ulcer in Spitz 51.85%, non-descript 22.22%, Lhasa apso 7.41%, Great dane, German shepherd, Pug, Bull terrier & Terrier 3.7% whereas, Ramani et al. (2012) reported the highest incidence in Pug 37.26%, followed by Spitz 26.7%, non-descript 16.7%, Boxer and Labrador both had the incidence rate of 4.94%.

In the present study higher incidence of corneal ulcer reported in non-descript followed by Pomeranian may be due to the more population of such dogs.

5.2.4 Etiology

Self trauma by pawing (66.66%) emerged to be the major cause of corneal ulcer, whereas a corneal aberration after the automobile accident (25%) and keratoconjunctivitis sicca (8.33%) was also the causes of corneal ulcer.

Wilkie and Whittaker (1997) also found similar findings and reported that (57.14%) corneal ulcer occurred due to corneal injury followed by entropion (26.31%) and KCS (8.78%).

This finding may be based upon the fact that most of the dog reported in this study were non-descript. These dogs are more likely to be involved in dogs are also allowed to roam free making them a greater risk for accidental injuries. Another reason included that, they were found to be more prone to skin infections and dermatitis which lead to pawing.
5.2.5 Duration

The course of illness as revealed by the history indicated that maximum course of illness was between 10 to 15 days i.e. in 7 cases (58.33%), followed by a period of a 5 to 10 days i.e. in 3 cases (25%) and lastly in 2 cases about 1 to 2 days (16.66%). The time interval between trauma and presentation ranged from 1 to 15 days. This observation reflected the concern of the owner for his/her pet however, the distance was not only a regulatory factor for presentation of the pet at TVCC. The socioeconomic status may also be a contributing factor for variation in presentation of animal for treatment at a hospital. Further, this may also be attributed to the fact that at the time of starting of ulcer, minor abrasions developed which was very difficult to notice by naked eye and as soon as clinical symptoms progressed, the owners brought the dog for check up.

5.2.6 Feeding habit

It was interesting to note that 66.66% dogs with corneal ulcer were non-vegetarians in the present study. It is the established fact that the vitamin A plays a major role in the vision of eye. The non-vegetarian diet remains deficient in vitamin A and its precursor. Thus, when it was fed for a long period, animal became deficient especially to vitamin A. In contrast to the fact the vegetarian diet milk, salad, greens etc being rich in vitamin A might be responsible for slow or delayed eye pathogenesis as also recorded in the present study 33.33%.

5.3 Pre-operative ophthalmic examination

In gross examination majority of the dogs showed mild to moderate lacrimation, congestion and mild corneal opacity accompanied. Intraocular pressure was normal and none of the dog was diagnosed for glaucoma with corneal ulcer. All the dogs responded to menace reflex, direct pupillary light reflex and dazzle reflex. These findings were similar to the
findings of Gelatt (1981), Ramani and David (2005), Mitchell (2006) and Ruxandra (2012). However, blepharospasm, red eyes (conjunctival hyperemia and or congestion) and ocular discharge has also been reported, as the most common clinical signs.

In the present study lacrimation, congestion and corneal opacity occurred may be due to the trauma, irritation, pain and photophobia because of ulcer. keratokunjunctivitis sicca was observed may be due to the other intra-ocular pathology and late presentation of case, which was converted into chronic case.

5.3.1 Schirmer tear test

In the present study in all the dogs schirmer tear test was measured which ranged for 22 to 26 mm/min, as it was higher than the normal limits. It indicated higher lacrimation in all the cases except in one dog where it was measured 4 mm/min, which was lower than the normal range and dogs were diagnosed for dry eye condition due to Keratoconjuntivitis sicca. Present findings were in consonance with the findings of Murphy (2015) and Gelatt (1981). In the present study schirmer tear test range was higher; this may be due to excessive lacrimation produced because of continuous itching, pawing, irritation, pain and photophobia due to the ulcer.

5.3.2 Ophthalmoscopic examination

In the present study tonometry, direct ophthalmoscopy and ultrasonographic examination was performed in all the dogs but no abnormality and intraocular pathology was seen in any of the dog. Chahory et al. (2003) opined that intraocular pressure measured before the corneal ulcer surgery rule out glaucoma in dog. Williams et al. (2004) also advised the ophthalmoscopy and ultrasonographic examination before the corneal ulcer surgery. This may be attributed to the fact that corneal ulcer involved only superficial and deep layers of the cornea without involvement of other intra and extra-ocular structures of the eye.
5.3.3 Fluorescein dye test

In all the cases fluorescein dye test showed the different location of corneal ulcer along with their size. The stain adheres to any areas where the epithelium of cornea was missing and where the underlying layer, collagen or stroma was exposed. It gives fluorescent green stain around the border of the corneal ulcer for better visualization. These finding were in accordance with the observation of Schoster, (2012) and Singh et al. (2015). Fluorescein dye test was done in the present study because of the fact that minor superficial corneal ulcers were not visualized by naked eye and size of corneal ulcer was also not measured without demarcation of periphery of corneal ulcer.

5.3.4 Location of corneal ulcer

In the present study, majority of the corneal ulcers were located in inferior temporal (33.33%) followed by axial (16.67%), peripheral (16.67%) and inferior nasal (16.67%) positions. In few dogs paraxial and perilimbal location was also observed. These findings were indifferent with the findings of Paula et al. (2011) who observed corneal ulcer at the centre of the cornea in 40.14% dogs. In the present study corneal ulcer were located mostly in inferior temporal position which might be because of the fact that wherever cornea is injured it irritates the dog, and at the time of pawing dogs may injure the lateral aspect of cornea from its nail.

5.3.5 Size of corneal ulcer

In the present study size of corneal ulcer was measured and it ranged between 2 mm to 5 mm. Majority of the dogs were suffering with moderate corneal ulcer (83.33%) and less cases (16.66%) were reported for severe corneal ulcer. This may be attributed to the fact that corneal ulcer was not easy to diagnose by the pets owner’s during initial stage of development and it is only noticed by the owner at late phase when various clinical signs and symptoms like ocular discharge, corneal opacity, inflammation were exhibited.
5.3.6 Depth of ulcer

Majority of the dogs were suffering with moderate corneal ulcer (83.33%) and there was no involvement of the stromal layer of the cornea, whereas 16.66% of dogs were reported for severe corneal ulcer where depth extend upto mid stromal layer of cornea. Raymond *et al.* (2012) also reported the similar findings and recorded superficial corneal ulcer in 74% dogs and deep corneal ulcer in 26% dogs. This may be attributed to the fact that negligence of the owner as well as difficulty to diagnose corneal ulcer in initial stage.

5.4 Microbiological examination

5.4.1 Bacterial infection

All the dogs were suffering with bacterial infection, 58.33% dogs were positive for Gram +ve bacteria. Out of which 2 dogs were showing Gram +ve cocci in short chains and 5 dogs were showing Gram +ve rods in short and long chains. In 8.33% dogs Gram –ve coco bacilli infection was observed whereas in 33.33% dogs mixed bacterial infection was seen. Present findings were in consonance with the observations of Petersen (2007) and Ramani *et al.* (2013) who suggested bacterial infection in most of the dogs. In the present study bacterial infection was found in most of the dogs which might be due to exposure of moist corneal surface from the surrounding environment and moist and abraded surface of cornea easily pickup the infection another reason for mixed infection may be attributed that because of the presence of ulcer a lot of debris, necrotic material and inflammatory cells accumulate at the site which acts as a good medium for the growth of bacteria.

5.4.2 Fungal infection

In the present study 25% culture taken from corneal ulcer were showing septate and 16.66% cases were showing non septate hyphae, they were indicative for fungal infection. Thus total 5 dogs were showing mixed infection (Both fungal and bacterial) which account 41.66%. Similar finding were also reported by Prado *et al.* (2006). Mixed infection in the present study
may be attributed to the fact moist and abraded corneal surface of dog easily pick up the contamination from the surroundings also necrotic material may attract fungal growth.

5.4.3 Antibiotic sensitivity test

In the present study 58.33% dogs were sensitive, 33.33% were dogs intermediate and 8.33% dogs were resistant for moxifloxacin. The other antibiotics such as cefoperazone, amikacin and gentamicin were also sensitive towards the bacterial infection.

Prado et al. (2006) reported bacterial growth in 100% samples and it was sensitive to the gentamicin, ciprofloxacin, chloramphenicol and tobramycin. Ramani et al. (2013) also found that the pathogens were more sensitive to cefotaxime followed by enrofloxacin, tetracycline, gentamicin, azithromycin and amoxicillin.

In the present study antibiotic moxifloxacin was used which is a recent antibiotic used for the treatment of corneal ulcer in human patients. It has great penetration power and easily enters into the deep layer of cornea and hence it is effective for Gram +ve as well as Gram –ve bacteria.

5.5 Operative studies

5.5.1 Anaesthesia

The General anaesthesia was given after atropinization with xylazine hydrochloride, I/M followed by ketamine hydrochloride, I/V and was found excellent for under taking the corneal ulcer surgery in dog. Patient rarely awaked during the surgery and cardio pulmonary function were maintained normal throughout the duration of surgery. Further, added advantage of this anaesthesia was centrally fixed eyeball, which allowed a comfortable surgery. Recovery from the anaesthesia in these cases was smooth and it was well tolerated in all the age group of dogs. This anaesthesia appeared to be better because of its easy induction and maintenance and also appeared to be cheaper than the others.
Spreull et al. (1980), Fichman (1996), Shafiuzama et al. (1998), Kilic and Unsaldi (2005), Bhadsavle (2006) and Kumar (2008) have also followed the same premedication and anaesthesia protocol and opined that there was smooth induction and recovery from anaesthesia with desired pupillary dilatation during surgery.

Gelatt (1981), Cugini et al. (1997) and Hazra and Samanta (1999) performed cataract surgery under ketamine induced sedation and concluded that it did not influence IOP and enabled comfortable completion of surgery.

5.6 Pre-operative and post operative therapy

In the present study Tab. moxifloxacin hydrochloride, meloxicam and multi vitamins, minerals and ginseng tablets was given as systemic treatment and eye drop moxifloxacin, flurbiprofen and atropine sulphate eye ointment was applied topically. This treatment protocol was found effective to control infection to promote healing of corneal ulcer.

There are numbers of different studies in human patients and also in dogs which used this protocols for the treatment of corneal ulcer included Constantinou et al. (2007), Shah et al. (2010), Miller (2008), Weiner (2012) Raymond, et al. (2012) and Sharma et al. (2013) also reported combination of moxifloxacin hydrochloride as an effective antibiotic to control infection.

The finding of the present investigation has been in agreement with Gaynes and Onyekwuluje (2008) and Esme et al. (2011) who have also advocated the use of topical and systemic medications prior to surgery in dogs.

In the present study this pre-operative treatment protocol ensured infection free atmosphere in the eye before performing surgery and also after surgery.
5.7 Assessment of the healing of corneal ulcer

In the present study, size of corneal ulcer reduced in 10 dogs while remaining 2 dogs showed complete healing and only scar was present on 15th post-operative day. On 30th post-operative day corneal ulcer completely healed with scar except one where scar was not observed. On 45th day, 50% dogs of group I recovered completely and transparency of cornea was maintained, whereas in rest slight abraded area/scar at the point of ulcer was observed. In group II complete healing without scar formation was observed in 33.33% cases and scar was present in 66.66% cases. On 60th day in most of the dogs scar was not observed.

Nasisse (1995), Wilkie and Whittaker (1997), Miller (2001), Schoster (2002), Moore, (2003), Kim (2009) and Singh et al. (2015) observed similar findings and reported that in 78.58% cases superficial corneal ulcer was completely healed after 2 to 3 weeks and 56% cases of deep corneal ulcer healed 45 days after surgery and only scar was present in deep corneal ulcer.

Similarly delayed healing in the central region may be attributed to the fact that central region is more exposed to the external environment due to its elevated position and chances of injury were maximum at this area. Similarly when only anterior epithelium is injured it heals rapidly as compared to the deep ulcers where, different layer are too injured and eroded.

5.8 Complications

Ocular discharge, swelling of eye lid margin, inflammation of third eye lid, loosening of suture, discomfort and continuous itching by paw were observed in the present study. Morgan (2004), Petersen and Crispin (2002) and Wilkie and Whittaker (1997) also observed same complications. In the present study various complications were observed, this may be because of fact that dogs feel uneasiness and discomfort due to bandage, Elizabethan collar and irritation due to suture after surgery.
6. SUMMARY, CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

6.1 Summary

The present study was undertaken on 12 dogs irrespective of age, sex and breed, having corneal ulcer to evaluate the response of therapeutic procedures on corneal ulcer. The animals were randomly divided into two groups, in group I temporary tarsorrhaphy and in group II third eyelid flap surgery was performed along with systemic and local medication.

The clinical, ophthalmoscopic, haemato-biochemical and microbiological examination of each animal were conducted at 0 day before starting the treatment to check the general health status of the animals. Followed by on 15th, 30th, 45th and 60th post-operative day, record the healing of corneal ulcer.

Total 8760 cases of dogs registered at TVCC during the study period. Out of which 1.39% dogs were suffering with various eye affections. During the study period total 0.18% dogs were found suffering with corneal ulcer. Majority of the animals was affected with cataract (38.52%), followed by corneal ulcer (13.11%). The incidence of rest of the eye affections was less. Majority of animals were non-descript (38.62%), between 6 to 10 years (47.54%) of age. Sex wise incidence of various eye affection was higher in male (70.49%) dogs.

Corneal ulcer was higher in 6-10 years (66.67%) of age dogs. Most of the animals under the study were non-descript (58.33%). Sex wise distribution of corneal ulcer was higher in males (66.66%) than females. Self trauma by pawing (66.66%) emerged to be the major cause of corneal ulcer, whereas a corneal aberration after the automobile accident (25%) and keratoconjunctivitis sicca (8.33%) was also the causes of corneal ulcer.

The course of illness as revealed by the history indicated that maximum course of illness was between 10 to 15 days i.e. in 7 cases (58.33%). In all the dogs, 8 (66.67%) were non-vegetarian and (33.33%) were
vegetarian in dietary nature. The body weight of all the twelve dogs suffering with corneal ulcer was ranged between 8 to 22 kg.

In all the twelve dogs rectal temperature, respiration rate and pulse rate was within in the physiological limits. All the dogs were showing normal pink colour palpebral mucous membrane. Haemoglobin, total leukocyte count, differential leukocyte count and blood glucose level was also within the normal physiological range.

In gross examination majority of the dogs showed mild to moderate lacrimation, congestion and mild corneal opacity was also observed, intraocular pressure was normal and none of the dog was diagnosed for glaucoma with corneal ulcer. All the dogs responded to menace reflex, direct papillary light reflex and dazzle reflex,

In all the dogs schirmer tear test was measured which ranged 22 to 26 mm/min which was higher than the normal limits. It indicated higher lacrimation in all the cases except in one dog where it was measured 4 mm/min, which was lower than the normal range and dogs were diagnosed for dry eye condition due to Keratoconjunctivitis sicca.

In all the cases fluorescein dye test showing the different location of corneal ulcer along with their size. The stain adheres to any areas where the epithelium of cornea is missing and where the underlying layer, corneal, collagen or stroma has been exposed. It gives fluorescent green stain around the border of the corneal ulcer for better visualization of ulcer.

Out of all selected dogs majority of the corneal ulcers were located in inferior temporal (33.33%) followed by axial (16.67%), peripheral (16.67%) and inferior nasal (16.67%) positions. In few dogs paraxial and perilimbal location was also observed.

Size of corneal ulcer was measured in mm in all the dogs ranged between 2 mm to 5 mm and according to arbitrary score card given by Harrison (1975), majority of the dogs were suffering with moderate corneal ulcer (83.33%) and less cases (16.66%) were reported for severe corneal ulcer.
Majority of the dogs were suffering with moderate corneal ulcer and there is no involvement of the stromal layer of the cornea while less cases were reported for severe corneal ulcer where depth extend upto mid stromal layer of cornea.

Pre-operative microbiological examination was performed on 0 day before start of treatment in all the dogs of both groups. Majority of the dogs were positive for Gram +ve 58.33% and 08.33% were Gram –ve bacteria. Followed by 33.33% dogs suffering with mixed and 41.66% were positive for fungal infection.

Pre-operative antibiotic sensitivity test was performed in all the dogs. Out of 12 dogs, 7 (58.33%) dogs were sensitive, 4 (33.33%) dogs intermediate and 1 (8.33%) dog was resistant for moxifloxacin. In rest of the antibiotic discs, cefoperazone, amikacin and gentamicin also showed sensitivity towards the bacterial infection.

Size of corneal ulcer was reduced in 10 dogs remaining 2 dogs only scar was present on 15th post-operative day. On 30th post-operative day corneal ulcer was completely healed in all the dogs. On 45th and 60th post-operative day in all the cases of group I and II corneal ulcer were completely healed and only scar was present in severe cases and disappeared in moderate cases.
6.2 Conclusions

1. The incidence of various eye affections in dogs was 1.39 per cent whereas corneal ulcer was 0.18 per cent.

2. Incidence of corneal ulcer was more in middle age, non-descript, non vegetarian male dogs and major etiological factor was self trauma.

3. In group I lesser complications were observed as compared to group II and 66.66% and 50% dogs recovered without scar formation on 60\textsuperscript{th} post-operative day in group I and II respectively. Thus temporary tarsorrhaphy was observed superior then the third eyelid flap surgery.

4. Combination of moxifloxacin and flurbiprofen was found satisfactory for the healing of corneal ulcer.
6.3 Suggestions for further work

1. Moderate corneal ulcer can be treated with decellularized xenogenic corneal graft.

2. Severe corneal ulcer can be treated by corneal transplantation.
REFERENCES


Appendix 01: Pre-operative clinical and haemato-biochemical observation of dogs suffering with corneal ulcer

<table>
<thead>
<tr>
<th>Group</th>
<th>Case No.</th>
<th>Rectal temperature (°F)</th>
<th>Respiration rate (Per minute)</th>
<th>Pulse rate (Per minute)</th>
<th>Mucous membrane Colour</th>
<th>Haemoglobin estimations (g/dl)</th>
<th>Total leukocyte count (×10^3/µl)</th>
<th>Differential leukocyte count (Per cent)</th>
<th>Blood glucose (mg/dl)</th>
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Appendix 02: Pre-operative ophthalmic evaluation in dogs suffering with corneal ulcer

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<th>Group</th>
<th>Case No.</th>
<th>Gross examination</th>
<th>Schirmer tear test (mm/min.)</th>
<th>Location of ulcer</th>
<th>Size of corneal ulcer (mm/min.)</th>
<th>Depth of ulcer</th>
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Appendix 03: Pre-operative microbiological examination

<table>
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<tr>
<th>Group</th>
<th>Case No.</th>
<th>Bacterial infection (Gram's staining)</th>
<th>Fungal infection (10% KOH mount)</th>
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<tbody>
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<td></td>
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<td>Gram +ve</td>
<td>Gram -ve</td>
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Grading scale: Mild (+), Moderate (++) , Severe (+++), Absent (-)
### Appendix 04: Pre-operative antibiotic sensitivity test

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Grading scale: Sensitive (S), Resistant (R), Intermediate (I)
### Appendix 05: Post-operative assessment of healing of corneal ulcer

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<td>3 mm Mild</td>
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**Grading scale:** Scar present (+), Scar absent (-)