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Studies on incidence and clinical management of keratopathies in dogs

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Abstract
In the present study, Out of 24 cases of keratopathies, pigmentary keratitis and ulcerative keratitis (n=07 each) had highest incidence followed by superficial keratitis (n=06), endothelial dystrophy (n=03) and corneal degeneration (n=01). Pigmentary keratitis observed as dark blackish colour pigmentation covering 1/3rd quadrant to entire cornea and were managed by topical instillation of 3% cyclosporine fortified with corn oil, tacrolimus, antibiotic, steroids and artificial tear replacers. Superficial corneal ulcers were treated by topical installation of antibiotic, NSAIDs, artificial teat replacer, mydriatics and autologous serum which showed an uneventful recovery in 5-15 days. Superficial keratitis was observed in 12 eyes of 6 dogs. Ten eyes showed uneventful recovery with topical instillation of antibiotic, steroids and artificial tear replacer along with systemic administration of antibiotic, NSAIDs and antacids. Corneal endothelial dystrophy characterized by corneal opacity, corneal oedema and lacrimation was seen in 4 eyes of 3 dogs aged between 1 to 7 years treated by topical instillation of the 6% sodium chloride, antibiotic and steroidal anti-inflammatory drugs which completely recovered over a period of 7-90 days. Corneal degeneration was observed as white shiny crystalline opacity in the centre portion of the cornea with immature cataract in the left eye of 10 years old male Pomeranian dog treated by topical instillation of NSAIDs, artificial tear replacer and 5% EDTA which showed an uneventful recovery over a period of 4 months.

Keywords: Dog, keratopathies, ulcer, corneal degeneration, NSAIDs, keratitis

1. Introduction
The eye, organ of vision is located in the orbital cavity of the skull (Chawla *et al.,* 1993) [2]. The cornea, which comprise one fifth of the fibrous tunic of the eye, in healthy condition, is transparent and serves a major refractive function while maintaining a tough, physical and impermeable barrier between the environments (Gelatt, 2007) [10] it has five layers: Precorneal tear film, epithelium and basement membrane, stoma, Descemet's (basement membrane of the epithelium) and endothelium (Slatter and Dietrich, 2002) [23, 24]. Each part of the cornea heals in different degree, at a different rate via different mechanisms. An entirely denuded cornea can be re-epithelialized in 4 to 7 days (Crispin, 2002, Slatter and Dietrich, 2002) [4, 23, 24]. Keratopathies are categorized into inflammatory and non-inflammatory on the basis of causes (Gilger *et al.,* 2007) [11, 12, 13]. The successful treatment and management of keratopathies are mainly based on distinct diagnostic capability (Maggs, 2008) [16]. Different therapeutic management of keratopathies include topical instillation of autologous serum, anti-inflammatory, mydriatics, cyclosporine, hypertonic saline and surgical management viz., third eyelid flap, keratectomy (Grid and punctate), conjunctival pedicle grafting, application of tissue adhesives, soft contact lens, corneal transplantation and keratoplasty (Gilger *et al*., 2007) [11, 12, 13]. Objectives of the present study were to study the incidence of keratopathies and the efficacy of treatment regimens for management of keratopathies in dogs.

2. Materials and Methods
All the patients presented with keratopathy were examined in the order given below:
Signalment and history – Gross examination of the eye and its adnexal structures – Neuro-ophthalmological examination - Culture and sensitivity testing - Schirmer's tear test - Fluorescein staining - Tear Film Breakup Time.

2.1 Management of various keratopathies
2.1.1 Pigmentary keratitis

These cases were managed by topical instillation of 3% cyclosporine fortified with corn oil, antibiotic, steroids and artificial tear replacers four times a day along with tacrolimus ointment twice daily.

2.1.2 Superficial corneal ulcer
All the cases of superficial corneal ulcers were managed by topical instillation of antibiotic, NSAIDs, mydriatics and artificial tear replacers.

2.1.3 Descemetocele
Descemetocele was surgically managed by a third eyelid flap technique.

2.1.3.1 Patient preparation and anaesthesia
Overnight fasting was followed in all the animals prior to surgery. The surgery was performed under general anaesthesia using butorphanol @ 0.2 mg/kg IM, diazepam @ 0.5 mg/kg as pre-anaesthetics, 2.5% thiopentone sodium @ 5 mg/kg IV till effect for induction and isoflurane @ 1.5% for maintenance.

2.1.3.2 Technique
The third eyelid was pulled up over the eyeball and sutured to the dorsolateral region of upper eyelid using nylon suture material with the aid of a plastic stent. A small vent was kept open for timely inspection and instillation of medications into the eye.
Post-operatively, topical antibiotics, NSAIDs and mydriatics were instilled thrice a day till complete recovery along with application of elizabethan collar for prevention of the self-mutilation by the animal.

2.1.4 Superficial keratitis
All the cases of superficial keratitis were treated by topical instillation of antibiotic, steroidal anti-inflammatory, along with systemic antibiotic, NSAIDs and antacid.

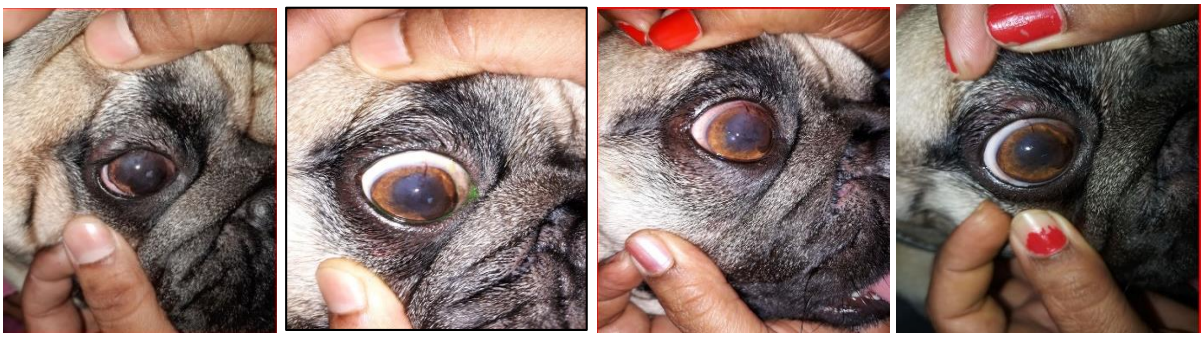
2.1.5 Endothelial dystrophy
All the cases of corneal endothelial dystrophy were managed by topical instillation of 6% sodium chloride ointment on alternate day and antibiotic and NSAIDs thrice daily.

2.1.6 Corneal degeneration
It was treated by topical instillation of the NSAIDs, artificial tear replacer and 5% Disodium Ethylene Diamine Tetra-Acetic Acid (EDTA).

Follow-up
Follow-up of the case was taken up until the complete recovery or a maximum period of 45 days. Complication, if any; was recorded and managed accordingly.

3. Results and Discussion
Out of 24 cases of keratopathies, incidence of pigmentary keratitis and ulcerative keratitis was highest (n=07 each, 29.17%) followed by superficial keratitis (n=06, 25%), endothelial dystrophy (n=03, 12.5%) and corneal degeneration (n=01, 4.16%). Ferrao (2013) reported 43.80 % (n=53) incidence of corneal affections out of 121 cases studied. Parikh *et al.,* (2012) [20] also reported highest incidence of corneal affections (35%) in a total of 425 dogs studied with ophthalmic affections. Ratnu *et al.,* (2017) [21] reported 185 cases of corneal affections out of 369 cases of ocular affections.

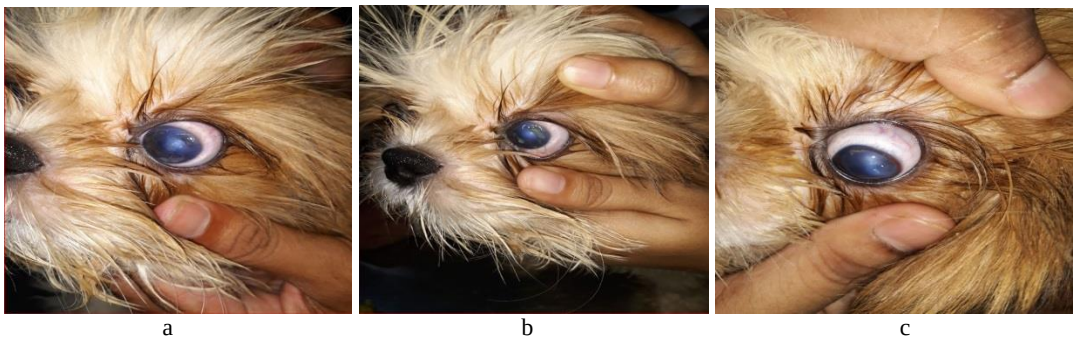
3.1 Clinical evaluation and management of keratopathies
3.1.1 Pigmentary keratitis
In the present study, all the cases were medically managed by topical instillation of 3% cyclosporine fortified with corn oil, antibiotics, steroids and artificial tear replacers along with tacrolimus ointment. Similar treatment regimen was also followed by Stiles *et al.,* (1995) [29] and Dhruw (2014) [5, 6] with beneficial effects. However, Slatter (1990) [25] and Massa (1999) [18] stated that pigmentary keratitis requires continued, life-long therapy to prevent further inflammation and pigment deposition. Spreading of pigment deposition was slow downed with reduction in ocular inflammation in all the eyes except in two eyes having complete corneal pigmentation. However, reduction in the size of the deposited pigment was not observed in any of the case.



a b c d

Fig 1: Pigmentary keratitis in a pug: day of presentation (a), 7th day (b), 21st day (c), 60th day (d).

3.1.2 Superficial corneal ulcer
All the cases of superficial corneal ulcer were treated by topical installation of antibiotics, NSAIDs, artificial tear replacer, mydriatics and autologus serum. Uneventful recovery over a period of 5 to 15 days was observed in all the cases. Champagne (2001) [1] found ciprofloxacin as the excellent choice for treating deep or melting ulcers, descemetocele, corneal perforations and refractory ulcers. Geerlings *et al.,* (2004) [9] reported that corneal epithelial cell morphology and function were better maintained by serum than pharmaceutical tear substitutes because serum by nature are non-allergenic and their biomechanical as well as biochemical properties are similar to normal tears. Ortiz *et al.,* (2012) [19] opined that the fundamental treatment for resolution of uncomplicated superficial ulcers included topical antimicrobial drugs, autologous serum and tear substitutes.



a b c

Fig 2: Superficial corneal ulcer in a Shih-Tzu: Before treatment (a), Positive fluorescein stain (b), 15th day after treatment (c).

3.1.3 Descemetocoele

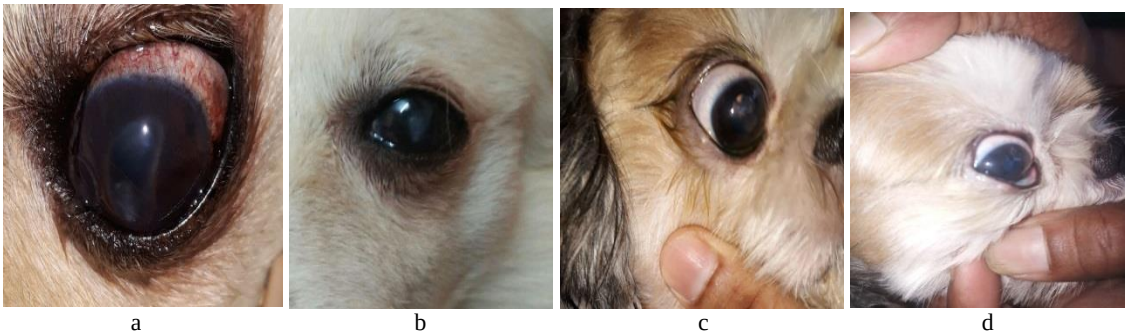
Both the cases were treated by third eyelid flap followed by topical instillation of antibiotic, mydriatics and NSAIDs along with systemic antibiotic, NSAIDs and antacid. Formation of fibrous tissue was observed by 8th post-operative day which subsequently becomes normal over a period of 2 months in both the cases. Magrane (1989) [17] stated that the sole use of membrana nictitans flap technique ensured healing and acted as a permanent seal which proved rewarding in management of descemetocoele. Hamor (2003) [15] reported that the third eye lid flap provided a readily available protective bandage for cornea in any condition where corneal coverage support or protection is required. Good *et al.,* (2003) [14] reported that most of the descemetocele could be repaired successfully using conjunctival grafts or third eyelid flaps. Dhruw (2014) [5, 6] also reported successful repair of descemetocele by third eyelid flap technique.

a b c d

Fig 3: Surgical management of descemetocoele in a Shih-Tzu: descemetocoele on the day of presentation (a), third eyelid flap in a position (b), intact flap on 7th day post operative (c), 21st day post operative (d).

3.1.4 Superficial keratitis

All the cases were treated by topical instillation of antibiotic, steroids and artificial tear replacer along with systemic antibiotic, NSAIDs and antacids. Stanley (1998) [28] reported that most cases of superficial stromal keratitis could be controlled with 6-10 times topical instillation of prednisolone which subsequently reduced to 1-2 times. However, he opined lifelong instillation of steroid. Stades *et al.,* (2007) [26, 27] also recommended the use of topical instillation of antibiotic and steroids for the management of superficial keratitis. In the present study, all the cases recovered uneventfully within a period of 10 days to 60 days except two eyes in which uveitis was also present.



a b c d

Fig 4: Superficial keratitis in dogs: Before treatment (a) and (c), After treatment (b) and (d).

3.1.5 Endothelial dystrophy

All cases of the endothelial dystrophies were medically managed by topical instillation of the 6% sodium chloride, antibiotic and steroidal anti-inflammatory drugs. All cases recovered between 7-90 days.

3.1.6 Corneal degeneration

The case was treated by topical instillation of NSAIDs, artificial tear replacer and 5% EDTA (Ethylene Diamine Tetra-Acetic Acid) for a period of four months. Crispin

(1987) [3] stated that treatment of underlying systemic disorders and feeding of a low-fat diet might prevented the crystalline corneal opacities from progressing and use of topical anti-inflammatory medications might exacerbate the lesion. Lesions can be removed by keratectomy if the opacity is disturbing the vision. Similarly, Gilger *et al.*, (2007) [11, 12, 13] also advised to treat the underlying cause, provide low fat diet and topical instillation of 1% disodium EDTA. Sansom and Blunden (2010) [22] treated three cases of corneal calcification with ulceration using topical artificial tear replacer, cyclosporine and 5% EDTA and reported improvement in one case over a period of 8 months and rest two animals were euthanized due to other systemic illness. Complete dissolution of the crystalline opacity was observed after a period of 4 months in the present study.

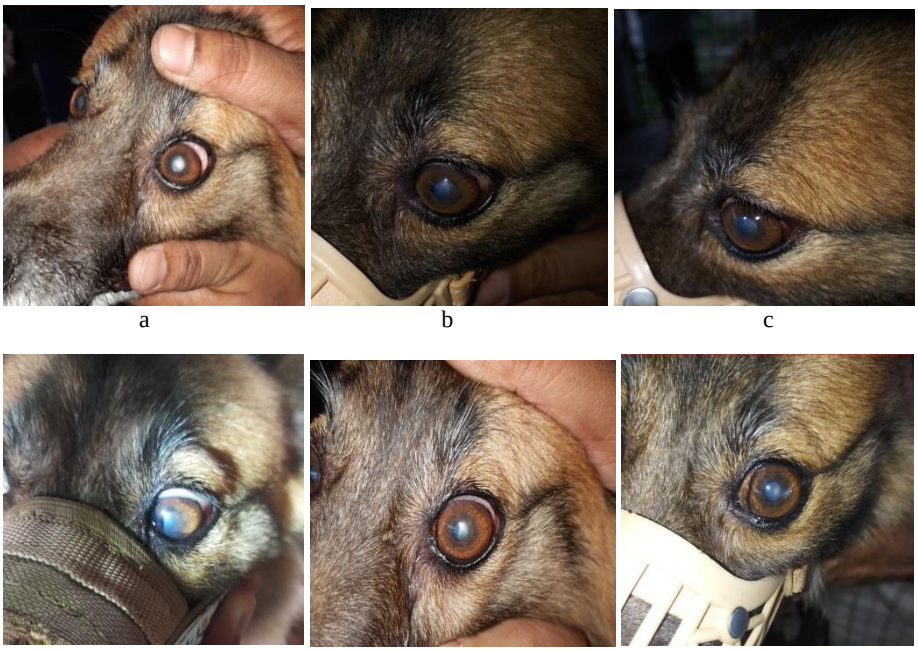


Fig 5: Corneal degeneration in dog; day of presentation (a), 12th day(b), 40th day(c), 60th day (d), 90th day (e), 120th day (f).

4. Conclusion

Based on results of the present clinical study following conclusions are drawn:

1. Keratopathies are most commonly seen in pugs.
2. Younger animals are more commonly affected than older animals.
3. Neuro-ophthalmic reflexes and special diagnostic procedures are important for the confirmatory diagnosis of keratopathies.
4. The medical management viz., mydriatics and autologous serum for ulcer, cyclosporine fortified with corn oil and tacrolimus ointment for pigmentary keratitis, steroidal anti-inflammatory and artificial tear replacer for superficial keratitis, 5% EDTA for the corneal degeneration and 6% sodium chloride in endothelial dystrophy found satisfactory along with antibiotic.
5. Third eyelid flap technique along with standard medical management gave satisfactory results in case of descemetocele.

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