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Haemato-Biochemical Changes Associated with Comparison of Intra Ocular Lens (IOL) Implantation with and without Capsular Tension Ring (CTR) Placement Following Phacoemulsification in Cataractous Dogs

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A B S T R A C T

The present study was conducted among twelve dogs of various breeds having mature cataract. Those dogs were randomly divided into two groups as A and B comprising six dogs in each group. Group B dogs were subjected for CTR placement, phacoemulsification and IOL implantation, and in Group A phacoemulsification followed by IOL implantation only. From all the dogs, blood samples were collected in EDTA coated as well as serum separation vials at different intervals during the observation period as follows: Pre-operatively (0 day) and 1st, 3rd, 7th, 14th, 21st, 30th, 60th, 90th, 120th, 150th, 180th and 210th day post-operatively. Those blood samples were subjected for various haematological and biochemical analysis. Total erythrocyte count and haemoglobin values were within normal range in all dogs of both the groups, whereas an apparent increase in the total leukocyte count and neutrophil values during 1st post-operative day was evident. The Lymphocytes, monocytes, eosinophils and basophils values were within the normal range. Alanine amino transferase, serum creatinine and blood glucose levels did not show any significant changes and were within the normal range in both the groups. Neither surgical procedure nor anaesthetic protocol did not alter the haemato-biochemical parameters.

Introduction

Phacoemulsification and intraocular lens (IOL) implantation are routinely performed for the management of cataract. The most common complication following Phacoemulsification and IOL implantation in human and canine eyes is posterior capsule opacification (PCO) (Bras *et al.*, 2006). Posterior capsule opacification is due to epithelial-mesenchymal transformation, proliferation and migration of residual lens epithelial cells (LECs) and can result in impaired vision and IOL decentration (Wilkie

and Colitz, 2013). There is an evidence to suggest that in addition to the design of the IOL, use of a capsular tension ring (CTR) may decrease PCO (Kim *et al.*, 2005). There have been limited reports of CTR use and safety in the dogs. Cataract surgery is one of the most common surgeries performed by veterinary ophthalmologists. As PCO has been shown to occur in 100% of canine eyes following cataract surgery (Bras *et al.*, 2006), implantation of a CTR may have value if it is capable of inhibiting LEC migration. Hence, the present study was undertaken to compare the efficacy of CTR on IOL implantation in association with haemato-biochemical changes in dogs.

Materials and Methods

For the present study, total of twelve dogs with the history of mature cataract were included which were presented to the Department of Surgery and Radiology, Veterinary College Hospital, Hebbal, Bangalore. All the dogs were subjected to detailed ophthalmic examination by gross and direct ophthalmoscopic examination of the eye pre-operatively and on 1st, 3rd, 7th, 14th, 21st, 30th, 60th, 90th, 120th, 150th, 180th and 210th day post-operatively. The visual function tests which included; menace reflex test, obstacle test, palpebral reflex test, pupillary light reflex test, tracking reflex, consensual reflex, corneal reflex, cotton ball test, Schirmer's tear test (STT), fluorescein dye test (FDT), fundus visibility, persistency of the capsular membrane transparency and measuring intraocular pressure by using Shciotz tonometer. They were subjected for clinical examination and haemato-biochemical assays to assess their fitness for the surgery and those animals whose test results were within normal range were selected for the study. Selection criteria for good surgical patients were as follows: Bilateral or unilateral, mature cataract, negative menace response, positive dazzle reflex, positive direct and consensual pupillary light reflexes (PLR), failed obstacle test in scotopic and photopic conditions, normal intraocular pressure (IOP), no pre-existing systemic disorders, well-mannered (controllable) dog with owner's cooperation. The selected twelve dogs were randomly divided into two groups viz., Group A and B comprising six dogs in each. Dogs of Group A were subjected for phacoemulsification and IOL implantation and of Group B were subjected for phacoemulsification followed by IOL implantation with CTR placement. All the dogs of both the groups were anaesthetized with Inj. Atropine sulphate @ 0.045 mg/kg BW, S/C and Inj. Xylazine hydrochloride @ 1 mg/kg BW, IM. After 15 - 20 minutes, general anaesthesia was induced with Inj. Thiopentone sodium @ 12.5 mg/kg BW, IV and maintained by Isoflurane using Surgivet® anaestetic apparatus.

The blood samples were collected for various haemato-biochemical parameters include haemoglobin (Hb) (g/dl), total erythrocyte count (TEC) (10^6/cmm), total leukocyte count (TLC) (10^3/cmm) and differential leukocyte count (DLC) (%) as per the standard procedure. The biochemical parameters viz., Alanine amino transferase (ALT) (IU/L), serum creatinine (mg/dl) were estimated by using ARTOS biochemical analyzer (Swemed Biomedicals Pvt. Ltd, Bangalore, India) and random blood sugar (mg/dl) were estimated by HemoCue® Glucose Analyser (Benaka Scientifics, Bangalore, India). All the results of the visual function test, clinical examination of the eye, haematological and biochemical studies were statistically analyzed by unpaired t-test, using computer based statistical programme Graph pad prism, and interpreted as per the procedure described by Snedecor and Cochran (1996) to arrive at conclusion.

Results and Discussion

The results of haematological and biochemical parameters recorded in both Group A and B dogs at different intervals of study period were presented.

Haematological parameters

Haemoglobin and total erythrocyte count in all the dogs were within the normal range and did not show any deviations from the normal values during the pre and post-operative study (Table 1).

Table.1 Mean±SE values of haemoglobin, total erythrocyte count and total leukocyte count in dogs of both the groups

Group	Days	Parameters		
		Haemoglobin (g/dl)	Total Erythrocyte Count (10^6/cmm)	Total Leukocyte Count (10^3/cmm)
A	**0 Day (Before)**	12.18±0.19	5.68±0.19	12.15±0.43
	0 Day (After)	12.28±0.24	5.59±0.18	12.57±0.32
	Day 1	12.32±0.34	5.48±0.24	13.85±0.20
	Day 3	12.32±0.52	5.88±0.59	13.05±0.37
	Day 7	12.74±0.33	5.83±0.31	12.89±0.36
	Day 14	12.90±0.23	5.85±0.23	12.77±0.34
	Day 21	12.72±0.24	5.56±0.16	12.61±0.33
	Day 30	12.83±0.16	5.76±0.23	12.45±0.32
	Day 60	12.55±0.10	5.74±0.18	12.31±0.33
	Day 90	12.83±0.12	5.82±0.14	12.12±0.32
	Day 120	12.72±0.13	5.72±0.17	11.95±0.33
	Day 150	12.69±0.24	5.85±0.13	11.75±0.33
	Day 180	12.64±0.90	5.85±0.12	11.61±0.33
	Day 210	12.59±0.80	5.71±0.11	11.34±0.29
B	**0 Day (Before)**	12.47±0.25	5.95±0.17	11.97±0.33
	0 Day (After)	12.56±0.27	5.95±0.16	12.48±0.37
	Day 1	12.61±0.21	6.10±0.18	13.93±0.22
	Day 3	12.92±0.47	5.50±0.45	12.94±0.18
	Day 7	12.74±0.23	5.99±0.30	12.58±0.17
	Day 14	12.26±0.50	5.68±0.13	12.31±0.16
	Day 21	12.69±0.40	6.23±0.22	12.13±0.18
	Day 30	12.89±0.48	5.91±0.18	11.93±0.18
	Day 60	12.89±0.56	5.96±0.16	11.81±0.17
	Day 90	12.87±0.43	5.60±0.37	11.75±0.13
	Day 120	12.88±0.41	5.63±0.25	11.63±0.13
	Day 150	12.71±0.39	5.61±0.27	11.46±0.12
	Day 180	12.75±0.40	5.66±0.28	11.41±0.14
	Day 210	12.86±0.26	5.63±0.23	11.01±0.17

Table.2 Mean±SE values of differential leukocyte count in dogs of both the groups

Days	Group	Parameters (%)				
		Neutrophils	Lymphocytes	Monocytes	Eosinophils	Basophils
0 (Before)	A	73.16±0.42	21.22±0.70	4.43±0.43	0.99±0.22	0.20±0.04
	B	74.10±1.34	20.22±0.69	4.03±0.66	1.10±0.13	0.55±0.11
0 (After)	A	75.82±0.76	18.34±0.93	4.37±0.53	1.20±0.18	0.27±0.03
	B	75.74±1.06	18.31±0.39	3.89±0.46	1.51±0.24	0.54±0.10
Day 1	A	78.33±0.63	17.82±1.06	2.94±0.65	1.77±0.29	0.21±0.06
	B	76.89±1.05	17.16±0.47	3.61±0.39	1.83±0.41	0.51±0.09
Day 3	A	75.38±0.49	19.49±0.86	3.99±0.45	1.94±0.25	0.26±0.04
	B	75.77±0.71	18.45±0.51	3.37±0.27	1.92±0.29	0.51±0.07
Day 7	A	74.39±0.41	19.74±0.79	4.40±0.38	1.10±0.22	0.38±0.03
	B	75.63±0.70	18.03±0.49	3.43±0.26	1.75±0.14	0.50±0.07
Day 14	A	73.88±0.40	19.70±0.72	4.68±0.36	1.32±0.19	0.43±0.03
	B	75.16±0.66	18.75±0.59	3.61±0.17	1.99±0.19	0.51±0.07
Day 21	A	73.55±0.39	19.87±0.69	4.80±0.25	1.39±0.25	0.40±0.04
	B	74.84±0.59	18.84±0.47	3.66±0.29	2.16±0.17	0.51±0.09
Day 30	A	73.22±0.39	20.14±0.41	4.73±0.16	2.21±0.19	0.54±0.08
	B	74.39±0.54	19.00±0.55	3.87±0.16	2.23±0.14	0.51±0.10
Day 60	A	72.97±0.36	20.67±0.49	4.13±0.24	1.74±0.12	0.49±0.08
	B	74.03±0.49	19.08±0.55	4.18±0.21	2.23±0.11	0.48±0.11
Day 90	A	72.76±0.36	20.72±0.42	4.31±0.20	1.71±0.07	0.51±0.07
	B	73.74±0.47	19.23±0.53	4.38±0.29	2.21±0.17	0.45±0.12
Day 120	A	72.51±0.33	20.24±0.33	4.78±0.23	1.86±0.06	0.62±0.08
	B	73.49±0.47	19.26±0.63	4.58±0.26	2.19±0.18	0.49±0.12
Day 150	A	72.36±0.28	20.08±0.29	4.94±0.21	1.98±0.05	0.64±0.09
	B	73.19±0.46	19.53±0.62	4.67±0.25	2.16±0.15	0.46±0.13
Day 180	A	71.93±0.24	20.80±0.36	4.63±0.35	1.96±0.06	0.69±0.08
	B	72.93±0.44	19.51±0.63	4.79±0.29	2.31±0.11	0.48±0.13
Day 210	A	71.54±0.19	20.88±0.23	4.91±0.21	2.02±0.07	0.65±0.06
	B	72.38±0.42	20.05±0.60	4.75±0.25	2.34±0.14	0.47±0.11

Table.3 Mean±SE values of alanine amino transferase, serum creatinine and random blood sugar levels in dogs of both the groups

Parameters		Alanine Amino Transferase (IU/L)	Serum Creatinine (mg/dL)	Random Blood Sugar (mg/dL)
Group	**Days**			
A	**Day 0 (before surgery)**	31.43±5.32	0.89±0.09	101.47±1.76
	Day 0 (after surgery)	33.71±5.51	0.97±0.11	93.70±2.13
	Day 1	37.69±5.35	0.98±0.12	98.07±2.01
	Day 3	46.94±8.07	0.99±0.13	97.12±1.58
	Day 7	38.24±6.46	0.87±0.21	100.44±2.32
	Day 14	45.24±4.32	0.86±0.19	98.72±1.58
	Day 21	35.30±5.06	0.91±0.15	99.84±1.48
	Day 30	33.47±4.00	0.96±0.19	99.52±1.95
	Day 60	34.01±3.09	0.91±0.17	97.52±1.77
	Day 90	31.11±2.83	0.84±0.16	100.86±3.32
	Day 120	28.64±2.45	0.79±0.15	100.57±2.57
	Day 150	28.62±2.12	0.79±0.13	101.06±4.05
	Day 180	27.65±1.73	0.70±0.10	101.81±2.69
	Day 210	25.58±2.62	0.66±0.08	104.73±1.63
B	**Day 0 (before surgery)**	28.34±8.36	1.02±0.15	102.53±1.90
	Day 0 (after surgery)	30.04±8.19	1.01±0.14	92.15±4.79
	Day 1	37.70±11.32	0.97±0.12	97.14±1.14
	Day 3	44.12±13.02	1.06±0.13	99.95±1.91
	Day 7	43.32±10.79	1.19±0.14	99.95±2.11
	Day 14	41.73±6.88	0.96±0.18	101.24±1.95
	Day 21	32.35±6.39	1.18±0.15	96.84±1.42
	Day 30	31.62±5.25	0.96±0.17	99.84±1.30
	Day 60	26.08±5.48	0.92±0.12	99.91±2.71
	Day 90	27.53±4.46	0.95±0.11	101.05±2.46
	Day 120	27.37±3.81	0.95±0.10	101.89±1.47
	Day 150	29.86±4.10	0.93±0.09	101.92±1.81
	Day 180	29.12±3.77	0.77±0.09	102.45±1.31
	Day 210	24.95±2.27	0.72±0.08	101.37±0.87

Similar findings were also reported by Lew and Lew (2009), Namratha (2012), Hmar (2014), Madan (2015), Amitha (2016) and Suresh *et al.,* (2019). Since the technique involved minor surgical procedures which did not result in any major blood loss, no changes in haemoglobin levels were observed. There was an apparent increase in the TLC at immediate post-surgery could be due to post-operative inflammatory changes, which is in agreement with Mahesh and Vasanth (2007), Namratha (2012), Hmar

(2014), Madan (2015), Amitha (2016) and Suresh *et al.,* (2019). There was also an apparent neutrophilia during the 1st post-operative day which might be due to post-operative inflammation at the surgical site and healing of the surgical wound. These findings were in accordance with reports of Hmar (2014), Madan (2015), Amitha (2016) and Suresh *et al.,* (2019). The values of lymphocytes, monocytes, eosinophils and basophils were within the normal physiological values (Table 2).

Biochemical parameters

The biochemical parameters *viz.* Alanine amino transferase, serum creatinine and blood glucose levels did not show any significant changes and were within the normal range (Table 3). Neither surgical procedure nor anaesthetic protocol did not alter the biochemical parameters. Similar observations were also reported by Sudha (2005), Lew and Lew (2009), Hmar (2014), Madan (2015), Amitha (2016) and Suresh *et al.,* (2019).

In conclusion, the haemato-biochemical changes induced by the procedures in both the groups were of transient and statistically insignificant in nature. This indicates the surgical procedure was minor, would not alter the liver and kidney functions greatly, thus proved to be safe and effective for the management of cataract in dogs. In comparison, Group B animals with CTR/IOL combination proved superior over Group A with IOL alone as far as development of PCO was concerned, vision improvement and owners response is concerned.

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