

# CHRONIC RENAL FAILURE IN DOGS AND ITS MANAGEMENT

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Renal disorders are very common critical disease conditions of dogs caused by various etiological factors like some nephrotoxins and infectious agents etc. Besides, reduced blood supply to renal tissues, shock and dehydration etc. also causes nephritic disorders. Amongst the nephrotoxic agents, the aminoglycoside antimicrobials like Neomycin, Gentamycin and Amikacin etc., and ethylene glycol causes severe nephrotoxicity. The chronic renal failure is the primary kidney disease, persists for months to years and is characterised by progressive destruction of nephrons.

To observe the clinical and haematobiochemical changes and therapeutic responses, a study was carried out in the clinical cases of chronic renal failure in dogs.

## Materials and Methods

For this study, 40 clinical cases of dogs of either sex and of different breeds suspected to be suffering from chronic renal failure with clinical signs like depression, fatigue, weight loss, weakness, dehydration, anorexia, nausea, vomiting, diarrhoea, oral ulcer, oliguria, lethargy, anaemia, tremor, ataxia etc., were screened by haematobiochemical examinations. Out of these, 18 clinical cases of chronic renal failure dogs were selected for the present study.

These clinical cases were randomly divided in 3 groups comprising 6 in each group i.e., Gr.II, Gr.III and Gr.IV. Another 6 healthy dogs of different age, sex and breed with routine vaccinations were selected and was considered as Gr.I and were given with normal diet.

The Gr.II dogs were considered as untreated control and were given with protein restricted diet only, while the 3<sup>rd</sup> Group (Gr.III) were, treated with Caltrol<sup>1</sup> (Calcitrol .25 mg) @ 1 cap daily orally for 12 weeks, Sufate suspension<sup>2</sup> (Sucralfate) @ 5 ml twice daily orally for 8 weeks, Sharkoferrol pet<sup>3</sup> (Ferric ammon citrate, calcium gluconate, folic acid etc.) @ 10 ml twice daily orally for 12 weeks, Eldervit<sup>4</sup> (vitamin B Complex) injection @ 1 ml 1/Mly on alternate days for eight weeks, Veta

A<sup>5</sup> (Vit.A) injection @ 2.5 ml 1/Mly per week for 16 weeks and Sporidex capsule<sup>6</sup> (250mg) @ 1 capsule twice daily orally for 7 days along with protein restricted diet.

The Gr.IV dogs were treated with Nephtone capsules, a product of M/S Indian Herbs Research and Supply Co. Ltd., Saharanpur and which is claimed to be a useful nephroprotective herbal drug was given @ 2-3 caps. twice daily for 16 weeks along with the protein restricted diet.

Besides ancillary treatment with fluids and antiemetics etc., were given as per requirement. The blood samples of each animal of each group were collected on 0 day and thereafter on 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 10<sup>th</sup>, and 16<sup>th</sup> weeks for haematological examinations like Hb, PCV, TEC, TLC and biochemical estimations of Serum Total Protein, Albumin, Urea, Creatinine, Calcium, Phosphorus and an enzyme like Gamma-glutamyl transferase by different standard methods.

The statistical analysis was done as described by Snedecor and Cochran (1967).

## Results and Discussion

The healthy dogs of Gr.I were very active, good physical condition and had normal appetite. The dogs of Gr.II, III and IV which were detected suffering from chronic renal failure showed the symptoms like depression, fatigue, weakness, dehydration, weight loss, anorexia, nausea, vomiting, diarrhoea, anaemia, oliguria, lethargy, tremors, oral ulcer etc., before treatment and simulated with the observations of Polzin *et.al*, (1983), and Schulze (1998) in dogs with chronic renal failure.

The dogs of Gr.II which were kept as untreated control gradually developed some nervous signs in advanced stages like ataxia, tremor, incoordination, seizures, syncope etc., and progressive deterioration of health. One dog died on 4<sup>th</sup> week and another on 6<sup>th</sup> week.

The dogs of Gr.III, however showed gradual improvements of the clinical signs. There was gradual improvements of appetite and alertness which simulated with the findings

of Andress *et al.*(2005). The mucous membranes became gradually pink as also reported by Kohn *et al.*(2004) who also treated the anaemic dogs with Sharkoferrol Pet.

Similarly in Gr.IV, there was also gradual improvements of the clinical signs.

The haematological changes of the dogs in different groups have been presented in Table-I.

**Table-I changes of Haematological values in different groups of dogs.**

Parameters	Groups	0 Day	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	4 <sup>th</sup> Week	6 <sup>th</sup> Week	10 <sup>th</sup> Week	16 <sup>th</sup> Week
<b>Hb (gm%)</b>	Gr. I	12.97 <sup>a</sup>	13.05 <sup>a</sup>	13.03 <sup>a</sup>	13.27 <sup>a</sup>	13.18 <sup>a</sup>	13.22 <sup>a</sup>	13.17 <sup>a</sup>
	Gr. II	7.78 <sup>b</sup>	7.67 <sup>b</sup>	7.42 <sup>b</sup>	7.30 <sup>c</sup>	7.20 <sup>c</sup>	6.76 <sup>c</sup>	6.54 <sup>c</sup>
	Gr. III	7.83 <sup>b</sup>	8.08 <sup>b</sup>	8.65 <sup>b</sup>	9.12 <sup>b+</sup>	9.55 <sup>b+</sup>	10.50 <sup>b+</sup>	10.58 <sup>b+</sup>
	Gr. IV	7.81 <sup>b</sup>	7.72 <sup>b</sup>	8.12 <sup>b</sup>	8.60 <sup>b</sup>	8.87 <sup>b</sup>	9.80 <sup>b+</sup>	10.30 <sup>b+</sup>
<b>TEC (million/mm<sup>3</sup>)</b>	Gr. I	7.55 <sup>a</sup>	7.54 <sup>a</sup>	7.58 <sup>a</sup>	7.62 <sup>a</sup>	7.66 <sup>a</sup>	7.76 <sup>a</sup>	7.73 <sup>a</sup>
	Gr. II	3.99 <sup>b</sup>	4.04 <sup>b</sup>	3.83 <sup>b</sup>	3.64 <sup>c</sup>	3.71 <sup>c</sup>	3.41 <sup>c</sup>	3.20 <sup>c</sup>
	Gr. III	4.09 <sup>b</sup>	4.28 <sup>b</sup>	4.71 <sup>b</sup>	5.06 <sup>b+</sup>	5.25 <sup>b+</sup>	5.61 <sup>b+</sup>	5.67 <sup>b+</sup>
	Gr. IV	3.89 <sup>b</sup>	3.89 <sup>b</sup>	4.06 <sup>b</sup>	4.17 <sup>c</sup>	4.40 <sup>bc</sup>	4.88 <sup>b+</sup>	5.37 <sup>b+</sup>
<b>PCV (%)</b>	Gr. I	40.83 <sup>a</sup>	41.17 <sup>a</sup>	41.17 <sup>a</sup>	41.17 <sup>a</sup>	40.00 <sup>a</sup>	41.50 <sup>a</sup>	41.67 <sup>a</sup>
	Gr. II	24.83 <sup>b</sup>	24.83 <sup>b</sup>	23.17 <sup>b</sup>	23.17 <sup>c</sup>	21.80 <sup>c</sup>	20.20 <sup>c</sup>	18.40 <sup>c</sup>
	Gr. III	24.83 <sup>b</sup>	25.17 <sup>b</sup>	26.50 <sup>b</sup>	28.02 <sup>b</sup>	30.01 <sup>b+</sup>	31.33 <sup>b+</sup>	31.83 <sup>b+</sup>
	Gr. IV	25.02 <sup>b</sup>	25.50 <sup>b</sup>	26.33 <sup>b</sup>	27.50 <sup>b</sup>	28.17 <sup>b</sup>	30.83 <sup>b+</sup>	31.67 <sup>b+</sup>
<b>TLC (thousands/mm<sup>3</sup>)</b>	Gr. I	11.96 <sup>b</sup>	11.90 <sup>b</sup>	11.93 <sup>b</sup>	11.95 <sup>b</sup>	12.08 <sup>c</sup>	12.12 <sup>c</sup>	12.08 <sup>c</sup>
	Gr. II	17.08 <sup>a</sup>	17.02 <sup>a</sup>	17.54 <sup>a</sup>	18.16 <sup>a</sup>	18.34 <sup>a</sup>	19.26 <sup>a</sup>	19.95 <sup>a+</sup>
	Gr. III	17.33 <sup>a</sup>	16.43 <sup>a</sup>	16.22 <sup>a</sup>	16.27 <sup>a</sup>	15.94 <sup>b</sup>	15.01 <sup>b+</sup>	13.86 <sup>b+</sup>
	Gr. IV	17.43 <sup>a</sup>	17.11 <sup>a</sup>	16.77 <sup>a</sup>	16.63 <sup>a</sup>	16.21 <sup>b</sup>	15.06 <sup>b+</sup>	14.15 <sup>b+</sup>

Values bearing at least one common superscript within the same column do not differ significantly (P>0.05).

+ Significant at 5% level (P<0.05) in comparison to its 0 day value.

It is clearly evident from the table that there was significant (P<0.05) declinations of Hb, TEC and PCV values in Gr.II, III and IV on 0 day in comparison to Gr.I, the healthy dogs, which might be due to gastrointestinal bleeding (Krawiec,1996) and deficiency of erythropoietin from the kidney (Martiarena *et al.* 2000) and also simulated with the findings of Borku *et al.*(2000) in dogs with chronic renal failure. But following therapy with Sharkoferrol Pet and Calcitrol etc., in Gr.III and Nephstone in Gr-IV, the levels gradually increased. Significant (P<0.05) improvements were noted from 4<sup>th</sup> week and onwards and the levels became almost normal

at the end of the experiment in both the groups though better improvements were noted in Gr.III than in Gr.IV.

The TLC level on 0 day was found to increase significantly (P<0.05) in the clinically affected dogs i.e. in Gr.II, III and IV than in the healthy dogs of Gr.I and it remained significantly (P<0.05) elevated in Gr.II, during the study. But with treatment of antibiotics and others in Gr.III, and Nephstone in Gr.IV, there were significant (P<0.05) declinations from 6<sup>th</sup> week and onwards.

The Serum biochemical changes of the dogs of different groups have been presented in Table-2.

**Table-2. The Serum Total Protein, Albumin, Calcium and Phosphorus values of the dogs of different groups.**

Parameters	Groups	0 Day	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	4 <sup>th</sup> Week	6 <sup>th</sup> Week	10 <sup>th</sup> Week	16 <sup>th</sup> Week
<b>Total protein (gm/dl)</b>	Gr. I	6.87 <sup>a</sup>	6.87 <sup>a</sup>	6.83 <sup>a</sup>	6.80 <sup>a</sup>	6.81 <sup>a</sup>	6.81 <sup>a</sup>	6.86 <sup>a</sup>
	Gr. II	4.29 <sup>b</sup>	4.23 <sup>b</sup>	4.16 <sup>b</sup>	4.03 <sup>b</sup>	4.04 <sup>c</sup>	3.70 <sup>c</sup>	3.41 <sup>c</sup>
	Gr. III	4.28 <sup>b</sup>	4.16 <sup>b</sup>	4.37 <sup>b</sup>	4.69 <sup>b+</sup>	5.17 <sup>b+</sup>	5.51 <sup>b+</sup>	5.61 <sup>b+</sup>
	Gr. IV	4.19 <sup>b</sup>	4.30 <sup>b</sup>	4.40 <sup>b</sup>	4.55 <sup>b</sup>	4.75 <sup>b</sup>	5.30 <sup>b+</sup>	5.69 <sup>b+</sup>
<b>Albumin (gm/dl)</b>	Gr. I	3.25 <sup>a</sup>	3.25 <sup>a</sup>	3.22 <sup>a</sup>	3.20 <sup>a</sup>	3.15 <sup>a</sup>	3.01 <sup>a</sup>	3.12 <sup>a</sup>
	Gr. II	2.36 <sup>b</sup>	2.36 <sup>b</sup>	2.28 <sup>b</sup>	2.18 <sup>b</sup>	2.14 <sup>c</sup>	1.91 <sup>b</sup>	1.79 <sup>b</sup>

	Gr. III	2.10 <sup>b</sup>	2.16 <sup>b</sup>	2.28 <sup>b</sup>	2.49 <sup>b+</sup>	2.67 <sup>b+</sup>	2.92 <sup>a+</sup>	3.05 <sup>a+</sup>
	Gr. IV	2.13 <sup>b</sup>	2.16 <sup>b</sup>	2.26 <sup>b</sup>	2.40 <sup>b</sup>	2.50 <sup>b+</sup>	2.75 <sup>a+</sup>	3.14 <sup>a+</sup>
<b>Calcium (mg/dl)</b>	Gr. I	9.97 <sup>a</sup>	10.17 <sup>a</sup>	10.25 <sup>a</sup>	10.10 <sup>a</sup>	10.33 <sup>a</sup>	10.50 <sup>b</sup>	10.33 <sup>b</sup>
	Gr. II	7.16 <sup>b</sup>	7.06 <sup>b</sup>	6.86 <sup>c</sup>	6.65 <sup>d</sup>	6.73 <sup>c</sup>	6.55 <sup>d+</sup>	6.10 <sup>c+</sup>
	Gr. III	7.00 <sup>b</sup>	7.10 <sup>b</sup>	7.64 <sup>b</sup>	8.72 <sup>b+</sup>	9.82 <sup>a+</sup>	11.33 <sup>a+</sup>	11.27 <sup>a+</sup>
	Gr. IV	7.06 <sup>b</sup>	6.80 <sup>b</sup>	7.09 <sup>bc</sup>	7.55 <sup>c+</sup>	8.31 <sup>b+</sup>	9.70 <sup>c+</sup>	11.06 <sup>a+</sup>
<b>Phosphorus (mg/dl)</b>	Gr. I	4.20 <sup>b</sup>	4.15 <sup>b</sup>	4.18 <sup>b</sup>	4.18 <sup>c</sup>	4.22 <sup>c</sup>	4.30 <sup>c</sup>	4.32 <sup>c</sup>
	Gr. II	9.43 <sup>a</sup>	9.58 <sup>a</sup>	9.78 <sup>a</sup>	9.98 <sup>a</sup>	10.12 <sup>a</sup>	10.48 <sup>a</sup>	10.80 <sup>a</sup>
	Gr. III	9.77 <sup>a</sup>	9.33 <sup>a</sup>	8.55 <sup>a+</sup>	7.62 <sup>b+</sup>	6.80 <sup>b+</sup>	5.62 <sup>b+</sup>	5.38 <sup>bc+</sup>
	Gr. IV	9.78 <sup>a</sup>	9.60 <sup>a</sup>	9.43 <sup>a</sup>	8.65 <sup>ab</sup>	7.83 <sup>b+</sup>	6.33 <sup>b+</sup>	5.57 <sup>b+</sup>

Values bearing at least one common superscript within the same column do not differ significantly (P>0.05).

+ Significant at 5% level (P<0.05) in comparison to its 0 day value.

The table clearly shows that, there was significant (P<0.05) reduction of Total protein and Albumin values in the clinically affected dogs of Gr.II, III & IV on 0 day than in Gr.I dogs. During the study, there was continuous deterioration of these values in Gr.II than the Gr.I dogs and it might be due to blood loss through gastrointestinal bleeding as well as protein urea which develop in CRF dogs and simulated with the findings of Kaneko(1989) and Devaux *et.al.* (1996) in dogs with chronic renal failure. But with different treatments in Gr.III, and with Nephtone in Gr.IV, there were significant (P<0.05) improvements from 4<sup>th</sup> week and the levels became almost normal at the end of the experiment. Treatment with sucralfate in Gr.III, prevented the gastrointestinal bleeding in uraemic dogs and helped to increase the protein levels.

The table also shows that there was significant (P<0.05) decrease of serum calcium values as well as significant (P<0.05) increase

of serum phosphorus values on 0 day in Gr.II, III, & IV than in Gr.I dogs and simulated with the findings of Krawiec (1996), Nagode *et al.* (1996) and Devaux *et.al.* (1996) in CRF dogs. Nagode *et.al* (1996) opined less absorption of calcium in the intestine occur due to less production of calcitrol from the damaged kidney while Devaux *et al.* (1996) remarked, in CRF dogs hyperphosphataemia occur due to poor glomerular filtration through damaged kidney.

During the study, there was further decrease of calcium and increase of phosphorus levels in Gr.II, while the calcium levels increased significantly (P<0.05) from 4<sup>th</sup> week in both Gr.III & IV and became almost normal from 10<sup>th</sup> week. Similarly the phosphors levels also declined significantly (P<0.05) from 4<sup>th</sup> week in Gr.III and from 6<sup>th</sup> week in Gr.IV. The treatment with sucralfate which acted as an intestinal phosphate binding agent helped to decrease the phosphorus level and calcitrol

**Table-3. Serum Urea, Creatinine and GGT values in different groups.**

Parameters	Groups	0 Day	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	4 <sup>th</sup> Week	6 <sup>th</sup> Week	10 <sup>th</sup> Week	16 <sup>th</sup> Week
<b>Urea (mg/dl)</b>	Gr. I	19.48 <sup>b</sup>	20.57 <sup>b</sup>	19.17 <sup>c</sup>	19.95 <sup>c</sup>	19.83 <sup>c</sup>	21.77 <sup>d</sup>	21.93 <sup>c</sup>
	Gr. II	141.40 <sup>a</sup>	143.81 <sup>a</sup>	158.21 <sup>a</sup>	170.06 <sup>a</sup>	167.28 <sup>a+</sup>	189.44 <sup>a+</sup>	219.08 <sup>a+</sup>
	Gr. III	144.77 <sup>a</sup>	138.36 <sup>a</sup>	126.07 <sup>b+</sup>	119.68 <sup>b+</sup>	107.58 <sup>b+</sup>	91.81 <sup>c+</sup>	88.79 <sup>b+</sup>
	Gr. IV	143.50 <sup>a</sup>	140.29 <sup>a</sup>	132.98 <sup>b</sup>	127.95 <sup>b+</sup>	115.05 <sup>b+</sup>	109.30 <sup>b+</sup>	87.04 <sup>b+</sup>
<b>Creatinine (mg/dl)</b>	Gr. I	0.54 <sup>b</sup>	0.55 <sup>b</sup>	0.61 <sup>b</sup>	0.53 <sup>b</sup>	0.63 <sup>c</sup>	0.61 <sup>c</sup>	0.57 <sup>c</sup>
	Gr. II	4.25 <sup>a</sup>	4.27 <sup>a</sup>	4.47 <sup>a</sup>	4.77 <sup>a</sup>	4.49 <sup>a</sup>	5.17 <sup>a</sup>	5.74 <sup>a</sup>
	Gr. III	4.53 <sup>a</sup>	4.49 <sup>a</sup>	4.09 <sup>a</sup>	3.86 <sup>a</sup>	3.16 <sup>b+</sup>	2.36 <sup>b+</sup>	2.27 <sup>b+</sup>
	Gr. IV	4.40 <sup>a</sup>	4.26 <sup>a</sup>	3.78 <sup>a</sup>	3.73 <sup>a</sup>	3.30 <sup>b</sup>	2.86 <sup>b+</sup>	2.33 <sup>b+</sup>
<b>GGT (I.U./litre)</b>	Gr. I	3.42 <sup>b</sup>	3.52 <sup>b</sup>	3.55 <sup>b</sup>	3.48 <sup>c</sup>	3.40 <sup>c</sup>	3.51 <sup>c</sup>	3.40 <sup>c</sup>
	Gr. II	7.37 <sup>a</sup>	7.40 <sup>a</sup>	7.72 <sup>a</sup>	7.66 <sup>a</sup>	8.12 <sup>a</sup>	9.26 <sup>a+</sup>	10.96 <sup>a+</sup>
	Gr. III	7.44 <sup>a</sup>	7.38 <sup>a</sup>	7.19 <sup>a</sup>	6.74 <sup>b+</sup>	5.92 <sup>b+</sup>	4.43 <sup>bc+</sup>	4.28 <sup>b+</sup>
	Gr. IV	7.52 <sup>a</sup>	7.32 <sup>a</sup>	7.05 <sup>a</sup>	6.59 <sup>b+</sup>	6.21 <sup>b+</sup>	4.73 <sup>b+</sup>	4.12 <sup>b+</sup>

Values bearing at least one common superscript within the same column do not differ significantly (P>0.05).

+ Significant at 5% level (P<0.05) in comparison to its 0 day value.

helped to increase the calcium levels in these dogs of Gr.III.

The changes in mean serum Urea, Creatinine and GGT levels in different groups have been presented in table-3. The table shows there was highly significant ( $P < 0.01$ ) increase of urea values in Gr.II, III and IV dogs in comparison to the healthy dogs of Gr.I on 0 day and simulated with the observations of Kerlin (1995) and Devaux *et al.* (1996) in CRF dogs who opined decreased filtration of non protein nitrogenous substances through the damaged glomeruli helped to increase the urea level.

But following treatment in Gr.III, with treatment of Calcitrol, Sucralfate and Sharkoferrol Pet and supplementation of protein restricted diet, the values gradually declined from the next observations and corroborated with the observations of Polzin *et al.* (1988) and Kronfeld (1994) who also opined this medication helped to improve the renal functions as well as helped for proper excretion of urea. The increased urea values in Gr.IV also declined with treatment of Nephtone.

The creatinine level was also found to increase in 0 day in the CRF dogs and supported the findings of Finco and Duncan (1976) and Kerlin (1995) in renal failure uraemic dogs and following therapy in Gr.III, the levels gradually decreased in the subsequent observations. Similar declination was also noted in Gr.IV.

The table-3 also shows that there was significant ( $P < 0.01$ ) increase of mean serum GGT levels in Gr.II, III & IV on 0 day in comparison to Gr.I and simulated with the findings of Heine (1991) in CRF dogs and might be due to more release of GGT from the damaged renal tubular cells in CRF.

The mean values remained elevated in Gr.II throughout the experiment, while in Gr.III, significant ( $P < 0.05$ ) declinations were noted from 4<sup>th</sup> week onwards in respect to their 0 day values with treatment of Sucralfate, Sharkoferrol and Calcitrol which helped to improve the renal functions and decrease of GGT values. Similarly in Gr.IV, the GGT values decreased significantly ( $P < 0.05$ ) from 4<sup>th</sup> week with treatment of Nephtone. The herbal ingredients of Nephtone, *Boehavia diffusa*, *Crataeva nurvala* and *Solanum nigrum* have antiinflammatory, diuretic and nephroprotective effects on kidney (Kirtikar and Basu, (1975) and the other ingredients *Tribulus terrestris*, *Bergenia ligulata*, *Eclipta*

*alba* and *Andrographis paniculata* have the anti-inflammatory, antiseptic and antioxidant effects as opined by Rastogi and Mehrotra (1985) which might have helped to improve the kidney functions and simulated with the observations of Nandy (2004) who treated the dogs of acute renal failure with Nephtone.

Besides, dietary management with protein restriction diet in both Gr.III and IV dogs also helped to reduce the uraemic complications.

But the haematobiochemical values could not reach to their normal levels at the end of the experiment of 16 weeks, since maximum parts of the kidney had irreversible renal structural lesions in these CRF dogs which was also opined by Polzin *et al.* (2000).

However it is concluded that for treatment of CRF dogs, the treatment with Calcitrol, Sucralfate and Sharkoferrol Pet etc., are very useful while the herbal therapy of Nephtone is also found effective for treatment of CRF dogs.

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