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Studies on efficacy of zap strap method of treatment for malignant tumours of skin and subcutaneous tissue in dogs - Clinical, physiological and haemato-biochemical evaluation

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Abstract
The present study was carried out to evaluate efficacy of zap strap method of treatment for malignant tumours of skin and subcutaneous tissue in dogs. There were no significance variations observed in physiological (rectal temperature, heart rate and respiratory rate), haematological (haemoglobin, total erythrocyte count, total leucocyte count and differential leucocyte count) and biochemical parameters (serum creatinine, serum alanine aminotransferase and serum alkaline phosphatase). There was non-significant increase in haemoglobin and total erythrocyte count in dogs subjected to zap strap method of treatment. There was a non-significant increase in total leukocyte count and differential leukocyte count which later came to the normal range post-operatively. There were no significant changes in serum alkaline phosphatase and serum alanine aminotransferase. There were no statistically significant changes in serum creatinine in dogs subjected to zap strap method of treatment, but pathological significant change was noticed in case 3, succumbed on 31st post-operative day. On the basis of observation and the evaluation during the present study it was concluded that the zap strap method of treatment is effective for skin and subcutaneous malignant tumours in dogs in terms of avoiding the risk of general anaesthesia, minimally invasive, owner's satisfaction and without any complications in dogs.

Keywords: Zap strap method, skin and subcutaneous malignant tumours, clinical, physiological, haemato-biochemical analysis

Introduction
Tumour (Neoplasm) is a purposeless multiplication of living cells. Tumours are common in carnivores as compared to other animals (Venugopalan, 2009) [10]. Tumour is an important disease in dogs and represents one of the major causes of death accounting for 27 % of all in purebred dogs (Simon *et al*., 2017) [7]. In dogs, approximately 25-30% of all neoplasms were reported to be arising from the skin. The incidence of cutaneous tumours in dogs ranked second next to mammary gland tumours (Nair *et al*., 2007) [3]. The most common malignant tumours in dogs and cats were mammary gland tumours, skin tumours, osteosarcomas and haemopoietic tumours. Cancer is a multistage process with a polyfactorial etiology. Its development results from the effect of various carcinogens such as ionizing radiation, chemicals and oncogenic viruses. The impact of many endogenous factors − genetic, immune and hormonal, is also very important. Under the effect of these factors, changes in the DNA 2 of genes often occur. Some dogs probably inherit some of abnormal genes that predispose for the malignant cell transformation (Todorova, 2006) [9].

Currently, clinical treatments for cancer include surgery, radiation therapy, chemotherapy and, more recently, immunotherapy and other small-molecule targeted therapies (nanoparticles), along with a combination of these strategies (Lucky *et al*., 2015) [2]. Removal of tumour mass by application of tensioning device was found to be the most effective treatment for cutaneous tumours in compromised dogs with a success rate of 100% (Pramodh, 2016 and Bharathraj, 2017) [5, 1]. Robles and Young (2019) [6] reported that the rubber band ligation (RBL) was found to be effective in managing grade 2–3 bleeding internal hemorrhoids. In the context as above, the present study has been undertaken to evaluate the efficacy of zap strap method of treatment in malignant tumours of skin and subcutaneous tissue in dogs.

History and clinical examination

Clinical cases of dogs presented with skin and subcutaneous tumours to the Department of Surgery and Radiology, Veterinary College, Hebbal, Bangalore were subjected to detailed physical, clinical, radiographic and histopathological examination. Among them, six dogs with skin and subcutaneous malignant tumours were selected for the study and were subjected to zap strap application around the tumour mass.

Materials and methods

Six dogs with skin and subcutaneous malignant tumours were selected for the study. Surgical site was prepared aseptically. Lignocaine HCL 2% was infiltrated locally at the base of tumour mass after induction of surface anaesthesia using Lignocaine 10%. The non-cooperative dogs were sedated by Atropine sulphate @ 0.04 mg/kg BW S/C and Xylazine HCl @ 1 mg/ kg BW I/M. In the pedenculous tumour mass, the zap strap was applied around the tumour mass externally and tightened to stop complete blood circulation to the tumour mass. For the non pedenculous or sessile wide based tumours, a tunnel was made at the centre of the tumour base and two zap straps were passed through the tunnel and tightened separately. Engorgement of veins on the tumour was indicating the effective ligation. Zap straps were tightened daily till the tumour mass sloughed off.

The efficacy of the treatment is evaluated based on physiological, clinical and haemato-biochemical evaluation. Various physiological parameters evaluated included rectal temperature (^{0}F), heart rate (beats/ minute) and respiratory rate (breaths/ minute). Heamato-biochemical parameters included, Hb (g%), TEC (Millions/ cmm), TLC (Thousand/ cmm), DLC (%), Serum creatinine (mg/dl), ALT (IU/L) and AST (IU/L). These parameters were recorded before the treatment and on 7th, 15th, 30th, 45th, and 60th days post treatment. All the results of clinical, haematological and biochemical parameters were statistically analysed using one way Analysis of variance with more than one observation per cell and means for the respective periods were tested by Dunnets post hoc test as described by Snedecor and Cochran (1994) [8] and conclusion was drawn regarding the clinical efficacy of application of zap strap in treating skin and subcutaneous malignant tumours in dogs.

Results and Discussion

Physiological parameters

The temperature, heart and respiratory rates in dogs subjected for zap strap method of treatment for skin and subcutaneous malignant tumours were statistically non-significant ($P \leq 0.05$). Pramodh (2016) [5] have also recorded non-significant variations in the physiological parameters in his studies on tensioning device (zip tie) application around the tumour mass in compromised dogs (Table 1).

Table 1: Rectal temperature, heart rate and respiratory rate in all the six dogs subjected to zap strap application

Days	Rectal temperature (°F) Mean ± SE	Heart rate (beats/min) Mean ± SE	Respiratory rate (breaths/min) Mean ± SE
0	101.4 ± 0.60	108.3 ± 8.83	58.17 ± 6.56
7	101.5 ± 0.18	109.2 ± 7.55	55.50 ± 6.06
14	101.2 ± 0.21	111.7 ± 6.51	54.33 ± 6.84
30	101.2 ± 0.15	112.2 ± 5.13	53.67 ± 4.49
45	101.3 ± 0.14	113.4 ± 3.52	52.42 ± 5.37
60	101.3 ± 0.19	115.6 ± 3.40	53.22 ± 5.16

Haematological Parameters

There was non-significant increase in haemoglobin and total erythrocyte count in dogs subjected to zap strap method of treatment. There was a non-significant increase in total leukocyte count and differential leukocyte count which later came to the normal range post-operatively (Table 2). Similar findings were also recorded by Bharathraj (2017) [1], that no significant changes in haematological parameters were seen in dogs subjected to tumour excision by zip tie application. Onkologie and Rohrbach (1998) [4] opined that tumour itself can lead to a typical "anemia of chronic disease" which is normochromic, normocytic, accompanied by both a reduced number of reticulocytes and reduced iron-binding capacity. Cytokines such as interleukin-1, interleukin-6, and tumor necrosis factor seem to be involved in suppressing erythropoiesis by acting on the bone marrow and on erythropoietin production. Increase in haemoglobin value post-operatively could be due to removal of tumour which was primary cause for the production of cytokines.

Table 2: Haemoglobin, total erythrocyte count, and total leukocyte count in all the six dogs subjected to zap strap application

Days	Haemoglobin (gm/dl) Mean ± SE	Total erythrocyte count (10^6 cells/cmm) Mean ± SE	Total leukocyte count (10^3 cells/cmm) Mean ± SE
0	10.83 ± 1.58	5.30 ± 0.55	14.73 ± 2.85
7	12.70 ± 1.56	5.72 ± 0.55	15.28 ± 0.75
15	12.67 ± 1.55	5.75 ± 0.56	14.38 ± 0.91
30	13.44 ± 1.58	6.02 ± 0.36	14.16 ± 0.81
45	13.98 ± 1.47	6.26 ± 0.47	13.38 ± 0.83
60	14.29 ± 1.48	6.55 ± 0.46	12.78 ± 0.80

There was a non-significant increase in total leukocyte count and differential leukocyte count which later came to the normal range post-operatively (Table 3). This may be due to the inflammation created by the zap-strap which was applied around the base of tumour mass. The aforesaid results were confirmatory with Pramodh (2016) [5] and Bharathraj (2017) [1], that no significant changes in total leukocyte count was seen in dogs subjected to tumour excision by zip tie application.

Table 3: Differential leukocyte count in all the six dogs subjected to zap strap application

Days	Neutrophils (%) Mean ± SE	Lymphocytes (%) Mean ± SE	Monocytes (%) Mean ± SE	Basophils (%) Mean ± SE	Eosinophils (%) Mean ± SE
0	79.17 ± 0.74	14.62 ± 0.62	3.85 ± 0.48	0.42 ± 0.21	2.38 ± 0.54
7	79.21 ± 0.70	15.30 ± 0.54	4.23 ± 0.49	0.50 ± 0.22	0.72 ± 0.49
15	78.03 ± 0.59	15.71 ± 0.52	4.24 ± 0.55	0.43 ± 0.37	1.19 ± 0.41
30	77.77 ± 0.42	16.07 ± 0.50	4.48 ± 0.50	0.75 ± 0.32	0.88 ± 0.27
45	77.63 ± 0.41	16.36 ± 0.48	4.66 ± 0.49	0.23 ± 0.11	0.72 ± 0.22
60	77.56 ± 0.42	16.69 ± 0.46	4.93 ± 0.52	0.13 ± 0.17	0.53 ± 0.13

There were no significant changes in serum alkaline phosphatase and serum alanine aminotransferase in dogs subjected to zap strap method of treatment (Table 4). There were no statistically significant changes in serum creatinine in dogs subjected to zap strap method of treatment, but pathological significant change was noticed in case 3, succumbed on 31st post-operative day, owing to senility and chronic kidney failure. The results were also in accordance with Bharathraj (2017) [1], that there was no significant change in serum creatinine, serum alkaline phosphatase and serum alanine aminotransferase levels seen in dogs subjected

to tumour excision by zip tie application.

Table 4: Serum creatinine, serum alanine aminotransferase, serum alkaline phosphatase in all the six dogs subjected to zap strap application

Days	Serum creatinine (mg/dl) Mean ± SE	Serum alanine aminotransferase (IU/L) Mean ± SE	Serum alkaline phosphatase (IU/L) Mean ± SE
0	1.12 ± 0.21	28.40 ± 3.28	127.1 ± 1.34
7	1.60 ± 0.47	32.28 ± 5.24	138.6 ± 9.21
15	1.92 ± 0.73	31.54 ± 3.79	132.4 ± 2.39
30	3.11 ± 1.95	32.41 ± 4.07	131.4 ± 2.90
45	4.02 ± 2.92	33.16 ± 4.57	132.2 ± 4.72
60	4.74 ± 3.65	34.80 ± 5.84	133.0 ± 6.25

The main advantage of this method is the ischemia produced by local ligation which damages tumours selectively in such a manner that it causes extensive and sometimes complete necrosis of the tumour while unharming the normal tissues, except for transient inflammation. Apart from that, this technique is cost effective, specialized equipment is not required and can be practiced safely on pets whose owners are reluctant for surgery because of the risk involved with general anaesthesia. This method is also very much suitable for pets with hepatic or renal failure as general anaesthesia can be avoided.

Conclusion

It could be concluded that the removal of skin and subcutaneous malignant tumour mass by zap strap method of treatment was found to be the effective treatment in dogs. Among the selected cases for study, one dog showed new tumour growth 3 cm away from the previous site and other dog with pre-existing metastatic lesions in lungs pre-operatively become extensive on skiagram at 60^{th} post-operative day. In rest of the cases, wound healing was excellent with no recurrence of tumour

Summary

Zap strap method of treatment for skin and subcutaneous malignant tumours in dogs was found to be effective.

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