

Studies on Comparative Evaluation of Wound Healing between the Surgically Excised and Zap Strap Applied Tumour Wounds of Skin and Subcutaneous Tissue in Dogs

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Abstract: *The studies on comparative evaluation of wound healing between the surgically excised and zap strap applied tumour wounds of skin and subcutaneous tumours in dogs was carried out in twelve clinical cases of dogs. Group-A dogs were subjected to surgical excision of the tumour and Group-B dogs were subjected to zap strap application at base of tumour mass. Seroma formation, wound dehiscence and reoccurrence were noticed in two animals subjected to surgical excision of the tumour. The wound healing of the zap strap applied tumour wounds was found to be the most effective method for skin and subcutaneous tumours in dogs as, none of the animals showed recurrence during the period of study.*

Keywords: dogs; tumour; wound; zap strap

1. Introduction

A tumour (neoplasm) is resultant of a purposeless multiplication of living cells and it is different from inflammatory hyperplasia (Venugopalan, 2013). The skin is continuously exposed to a wide variety of chemical and physical insults and other environmental factors therefore, is prone to neoplastic proliferation. In dogs, approximately 30% of all neoplasms were reported to be of Cutaneous origin and found to be twice more frequent in comparison to man in which cutaneous tumours represent at least one third of all canine tumours. Approximately two thirds of all canine cutaneous tumours were solitary and benign with lesions originating from the epithelium or from adnexal structures including sebaceous glands, sweat glands and hair follicles (Pakhrin *et al.*, 2007). Anticancer therapy, especially in Veterinary Medicine, still in infancy and relies almost exclusively on surgical therapy, although associated therapies have also been developed over the past decades like chemotherapy and/or radiotherapy but not on par with human oncology, which is adapting recent techniques and methodologies in cryotherapy, immunotherapy and radiotherapy. The Veterinary oncology patients have been facing several risk factors that may increase the frequency of complications associated with wound healing (Cornell and Waters, 1995). Of these nutritional compromise and concomitant disease could be treated to improve the outcome of wound healing, but other factors such as tumor type and completeness of surgical excision have to be considered as well. Neo- adjuvant and adjuvant therapies such as chemotherapy, radiotherapy, and antiangiogenic medications have also been documented to augment wound healing (Seguin *et al.* 2006).

In the context as above, the present study has been undertaken to compare and evaluate the wound healing between the surgically excised and zap strap applied tumour wounds of skin and subcutaneous tissue in dogs.

2. Material and Methods

Source of animals and design of study

Clinical cases presented with skin and subcutaneous tumours were subjected to detailed physical examination and among them 12 case was selected and grouped into two with six animals each. Group A was subjected to surgical excision and Group B was subjected to zap strap application around tumour base.

Dogs selected for the present study included German Shepherds (3), Labrador (4), Non-descript (2), Pomeranian (2) and Pitbull (1). The age of the animals ranged from 5 years to 15 years. They weighed between 8 kg to 50 kg. Among these animals, 8 were females and 4 were males (Table 1).

In Group A, the six animals were subjected to conventional surgical excision of the tumour followed by wound dressing and parenteral antibiotic therapy. The dogs were fasted for 12 hours and water was withheld for 6 hours prior to surgery. Dogs were premedicated with Atropine sulphate (Atropine sulphate®, 1 ml ampule, Harson laboratories, Baroda) @ 0.045 mg/kg BW, S/C and TriflupromazineHCl (Siquil®, 5 ml vial, Zydus animal health care limited, Ahmedabad) at 1 mg/ kg body BW I/V. Ceftriaxone (Intacef pet®, 500 mg vial, Intas pharmaceuticals, Ahmedabad) was given as a preoperative antibiotic @ 20 mg/ kg BW I/V. The dogs were induced anesthesia using 2.5 % Thiopentone

sodium (Thiosol sodium®, 500 mg vial, Neon laboratories limited, Mumbai) @ 12.5 mg/ kg body weight I/V to the desired effect. Anesthesia was maintained using 2% Isoflurane in oxygen (Aerrane®, Baxter (India) Private Limited, Gurgaon). Under aseptic conditions, an elliptical incision was made at the base of tumour mass. Careful blunt dissection was made to free the tumour from surrounding tissues, muscle and fascia. The major blood vessels were isolated and ligated using chromic catgut no.1. The tumour mass was excised completely without leaving any remnants behind. Subcutaneous tissues were approximated using 1-0 chromic catgut and skin was closed with polyamide no.1, in mattress suture pattern. Post operatively wound dressing was done on alternate days along with a course of antibiotic, Cephalexin (Lixenpalatab®, Virbac animal health India private limited, Mumbai) orally @ 20 mg/kg BW BID for 5 days. Auto mutilation was prevented using Elizabethan collar. Sutures were removed on the 10th post operative day. (Fig.1)

In Group B, six dogs with skin and subcutaneous tumours were selected and subjected to zap strap was applied tightly around the tumour mass. Surgical site was prepared aseptically by clipping the hairs around and site was smeared with povidone iodine. The drapes were applied for aseptic surgery. Lignocaine 2% (LOX® 2%, Vial 30ml, Neon Laboratories, Mumbai) was infiltrated locally at the base of tumour mass. The dogs which are non-cooperative were tranquilized by TriflupromazineHCl (Siquil®, 5 ml vial, Zydus animal health care limited, Ahmedabad) @ 1 mg/ kg BW I/V. The zap strap or tensioning device, normally made of nylon, has a flexible tape section with teeth that engage with a pawl in the head to form a ratchet so that as the free end of the tape section is pulled the tie-wrap tightens and does not come undone (Fig.2). In the pedunculous tumour mass, the zap strap was applied around the tumour mass externally and was tightened to stop complete blood circulation to the tumour mass. For the non pedunculous tumours or the tumour which is attached firmly to the body, a tunnel was made at the centre of the tumour and two zip ties were passed through the tunnel and were tightened separately (Fig.3). Post-operatively, Zap strap was further tightened every day till the tumour became necrosed and got sloughed off. During the necrosis of tumour mass fly repellents were used to prevent maggot infestation. Wound was cleaned daily using antiseptic solution and self mutilation was prevented using Elizabethan collar.

Gross changes of the tumour in terms of size, wound healing and recurrence at the treatment site and clinical parameters like heart rate, rectal temperature, respiration rate were evaluated on 0th, 7th, 15th, 30th, 45th and 60th day after treatment. The blood samples were analysed for haemato-biochemical parameters like haemoglobin percentage, total erythrocyte count, total leukocyte count and differential leukocyte count, creatinine, alanine aminotransferase, aspartate transaminase and creatine kinase were evaluated on 0, 7th, 15th, 30th, 45th and 60th day after treatment.

Rate of wound healing was assessed by observing gross changes of wound at the operative site and by histopathological examination of the wound tissue collected by punch biopsy.

3. Results and Discussion

In Group A, among the six animals that underwent surgical excision of the tumour, the gross changes like redness, swelling and pain was present on 0 day in all dogs. One animal showed severe seroma formation and wound dehiscence and one animal showed slight seroma formation around the 7th post operative day (Fig.4). All the animals showed excellent wound healing by the 15th post operative day except in case 1, which showed delayed wound healing due to wound dehiscence and severe seroma formation and wound healed completely by 60th postoperative day in all the cases. Tumour recurrence was seen after the 30th post operative day in case 3 subjected to surgical excision (Fig.5) and case 2 animal showed recurrence after five months of surgery. Seroma formation is associated with dead space and problematic drainage. In the present case seroma was associated with dehiscence of incision line and dead space created while removing bilateral inguinal tumour. These findings were also reported by Papazoglou *et al.* (2006). Recurrence was seen after the 30th post operative day in one of the animals subjected to surgical excision. Similar findings were also reported by Kashyap *et al.* (2014) who studied the surgical management of canine dermatological neoplasms in 5 dogs and recurrence was seen in one dog. The most significant risk factors for local recurrence were contaminated surgical margins and histological grade of tumour. The recurrence in our study could be due to incomplete surgical excision.

In Group B, zap strap was applied around the tumour base in six dogs. In all the dogs' tumour mass sloughed off by 4th post-operative day. Granulation tissue was formed by 5th day and showed excellent wound healing by 15th post-operative day. By 30th post-operative day wound was healed in all the dogs with little portion left. By 45th post-operative day in all the 6 dogs wound healed completely. By 60th post-operative day in all the dogs wound healed completely without any complications and with no recurrence of tumour (Fig.6). Accordance to Doyle (2012), the presence of granulation tissue indicates the beginning of the reparative stage. Good healthy granulation tissue is desirable as it is highly resistant to infection, allows wound contraction and rapid epithelialisation. The present findings are similar to the appearances recorded by Pramodh (2016) by ligation technique. Application of the zap strap was applied around the tumour base it completely blocked the blood supply lead to ischemic causing necrosis and sloughing off of the tumour mass.

Haematological parameters like haemoglobin percentage, total erythrocyte count, total leukocyte count and differential leukocyte count were found to be within normal range. But total leukocytes count showed significant difference between Group A and Group B on 0, 30th, and 60th day post surgery. Kumar (1998) recorded similar observations in his study. However, changes in leukogram changes viz, leukocytosis, neutrophilia with mild regenerative left shift were observed in the study done by Marconato *et al.* (2008) and Hosseini *et al.* (2014). Biochemical parameters like serum creatinine, alanine aminotransferase, aspartate transaminase and creatine kinase count were within normal range. Behera *et al.*

(2012) and Pramodh (2016) also recorded similar findings in his study.

Histopathological sections of 12 specimens of tumour mass collected from skin and subcutaneous tissues confirmed that, four were benign (Trichoblastoma, Histiocytoma, Hepatoid gland adenoma and Plasmacytoma) and eight were malignant in nature (Papillary cystic adenocarcinoma-1, Solid adenocarcinoma-1, complex adenocarcinoma-2, Fibrosarcoma-1, Cavernous hemangiosarcoma-1, Squamous cell carcinoma-1 and Lipid rich adenocarcinoma-1) (Fig.7). Histopathologically section of wound at 60th day showed complete total healing with top layer epithelisation with mature epithelial cells and granulation tissue formation in the dermis in both groups (Fig.8). In his study, Mukaratirwa *et al.* (2005) reported that the 10 most common tumours, comprising 73.7% of all cutaneous neoplasms, were mast cell tumours, Squamous cell carcinomas, perianal gland adenomas, lymphomas, benign melanomas, Haemangiosarcomas, sebaceous gland adenomas, fibrosarcomas, lipomas and malignant melanomas. Gupta and Tiwari (2009) reported that out of 109 tumours examined histopathologically, 52 (47.70%) were benign and 57 (52.29%) were malignant.

4. Conclusion

From the present study, it may be concluded that the wounds caused by zap strap application at tumour base of skin and subcutaneous originated tumours healed effectively when compared to surgical excision method as, none of the animals showed recurrence during the study period.

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Table 1: Details of the dogs selected for the study

Group	Case No.	Breed	Sex	Age (years)	Body Weight(kg)
Surgical excision (A)	1	German Shepherd	Female	9	21
	2	German Shepherd	Female	10	28
	3	Pomeranian	Female	8	9
	4	Labrador Retriever	Female	6	26
	5	German Shepherd	Male	9	37
	6	Labrador Retriever	Male	5	46
Zap strap application (B)	1	Pomeranian	Female	15	8
	2	Non descript	Female	15	22
	3	Non descript	Male	7	21
	4	Pitbull	Male	7	38
	5	Labrador Retriever	Female	6	43
	6	Labrador Retriever	Female	8	50



Figure 1: Photograph showing pre-surgical preparation, an elliptical incision at the base of tumour mass, complete tumour mass excision and placement of sutures and excised tumour mass



Figure 2: Photograph showing zap straps used for application around the base of tumour mass



Figure 3: Photograph showing passing of zap strap through the tunnel made at the centre of non pedanculous tumour, tightening of zap strap around the tumor mass and discoloration of tumour



Figure 4: Photographs of wounds in Group A on 7th day after surgical excision showing severe seroma formation and wound dehiscence



Figure 5: Photograph showing recurrence of tumour after 30th day in case 3 of Group A



Figure 6: Photographs showing 0 to 30th post-operative day of zap strap application

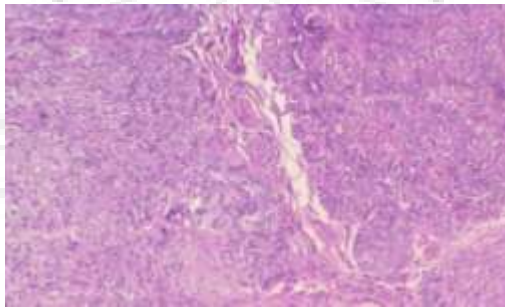


Figure 7: Photomicrograph of tumour from case no. 4 of Group A showing complex adenocarcinoma- with presence of both proliferative myoepithelial and epithelial cells arranged in a solid form

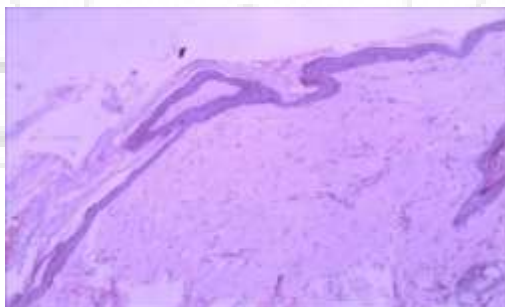


Figure 8: Section of tumour from case no. 4 of Group A showing healing with total epithelisation and granulation tissue formation in the dermis and also with no evidence of any neoplastic cells noticed on 60th postoperative day