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Laser-assisted leather punch technique for the management of aural haematoma in dogs

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Thirteen dogs presented with aural haematoma were used in this study. All the patients were managed by the use of a laser-assisted leather punch technique under general anaesthesia. The CO_2 laser was used to make 2 circular incisions on the concave surface of the ear. The haematoma was drained and the cavity was flushed. Multiple small focal tissue welding incisions were made to stimulate adhesion between the tissue layers. Postoperatively pressure bandaging along with standard care was observed. Haematoma was resolved in all the cases within a time period of 10-15 days without recurrence. The leather punch technique using CO_2 laser resulted in quick (8-14 days) healing with minimal scarring and contracture of pinna.

Key words: *Aural haematoma, Carbon dioxide laser, Dog, Laser treatment, Leather punch technique*

Aural haematoma is a clinical condition characterized by fluctuant swelling occupied with serosanguinous fluid in a part or the entire concave surface of the pinna (Slatter, 2003). It can affect one or both ears, commonly observed in dogs and cats, although cats are far less likely to be affected (Hnilica, 2010). In dogs, this condition does not seem to be a true haematoma but rather a serosanguinous effusion that develops over time (Kuwahara, 1986a).

The goals of the management of aural haematoma include evacuating the contents, obliterating dead space and preventing infection and recurrence (Lanz and Wood, 2004; Brown, 2010).

Medical management of aural haematoma is the most common and initial treatment of choice and has the best cosmetic outcome in companion animals (Hall *et al.*, 2004). This form of treatment is minimally invasive and cost-effective. It is ideal for early onset or smaller haematomas. This includes draining of the haematoma with needle and administration of intra-lesional steroids (methylprednisolone, triamcinolone, and dexamethasone) with daily oral steroid treatment (Romatowski, 1994). *In situ* administration of autologous L-PRP (leucocyte- and platelet-rich plasma) is also a safe and well-tolerated treatment for aural haematoma secondary to otitis externa in dogs, leading to a complete and long-term resolution of the disease (Perego *et al.*, 2021).

Surgical management is the most common treatment of choice for recurrent or persistent cases in dogs and cats. The most common surgical technique is giving S-shaped or linear incision, evacuating the haematoma contents particularly fibrin clots and obliterating the dead space with through and through Mattress sutures. Postoperative care involves head and ear compression bandages but these are quite uncomfortable to the animal and may also aggravate infection. If aural haematoma is not treated, there may be excessive scarring with cosmetically unacceptable pinnal deformations (Pavletic, 2015). Various complications can occur following surgery including cosmetic alteration of the ear, recurrence or pinnal necrosis (Cechner, 1998).

Other techniques to treat aural haematoma include cannula technique, drain placement, closed suction drainage and multiple circular fenestrations by CO_2 laser. The carbon dioxide (CO_2) laser is an ideal soft tissue surgical laser scalpel used to cut, ablate, or vaporize tissues (Winkler, 2019). It is a pulsed energy beam created by passing high voltage across CO_2 gas (Breen, 1989). In the veterinary literature, the CO_2 laser has been used for pharyngeal surgery, devocalization, dermatological surgery, and oncological surgery (Clark and Sinibaldi, 1994). Potential benefits of the CO_2 laser include decreased tissue trauma, scarring, postoperative swelling and edema, decreased haemorrhage, decreased postoperative pain, and sterilization of the surgical field (Klause and Roberts, 1990). In the present study a 'leather punch' technique using the CO_2 laser was evaluated for opening up the concave pinnal skin to allow drainage and treat aural haematoma in dogs.

Materials and Methods

Thirteen dogs, both male and female, affected with unilateral aural haematomas were included in the present study. In all the cases, there was a history of ear swelling filled with haemorrhagic fluid along with the complaint of head titling and constant ear scratching. In a few cases, needle aspiration was

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performed by local vet to evacuate the contents of the haematoma, however, recurrence was seen in those cases. All the cases were subjected to physical, clinical and haematological examination. On palpation, the swelling was warm to touch and revealed a soft fluctuating mass on the medial aspect of the ear. Based on the history and clinical examination, the condition was diagnosed as aural haematoma. All the patients were surgically managed with the use of CO_2 laser (SUDAR 300 CO_2 laser) by the leather-punch technique. In each case, the same anaesthetic protocol was followed. Preoperative medication included butorphanol (0.2 mg/kg body wt.), atropine sulphate (0.02 mg/kg body wt.) and amoxicillin-sulbactam (20 mg/kg body wt.) administered intramuscularly. After 15 min, diazepam (0.5 mg/kg body wt.) was administered intravenously, followed by propofol (3 mg/kg body wt.) given intravenously. Endotracheal intubation was done and anaesthesia was maintained using 2% isoflurane.

The animal was placed in lateral recumbency with the affected ear facing upwards. The ear pinna was shaved on both sides and was aseptically prepared. Cotton or gauze was placed in the ear canal to prevent ototoxic chlorhexidine scrub from entering the ear canal or any blood draining into the ear canal. This cotton was removed at the end of the surgery.

CO_2 laser-assisted leather punch technique was used for the treatment of aural haematoma. A sterile marker was used to outline the margins of the incision. A 1.4 mm spot-size laser tip at 8-12WRemoval of fibrin from the cavity

in continuous mode, depending on the thickness of the pinna was used for the procedure. Two circular holes, measuring 6-8 mm in diameter were made on the concave surface of the pinna by moving the hand piece in circular motion. Circular sections of skin and inner cartilage were removed and the two holes were used for draining and flushing of the haematoma. The cavity was thoroughly cleaned and fibrin clots were removed by moistened cotton swabs. Then multiple small focal tissue welding incisions (3-4 mm apart) with laser power ranging 8-10 Watt in CW mode were made over the entire surface, by moving the laser in uniform fashion surrounding the two large circular holes, extending over the surface of and just beyond the margins of haematoma. The multiple focal incisions were made to stimulate adhesion between the two tissue layers (Fig. 1). Different laser settings in continuous mode for circular incisions and welding were applied in different cases (Table 1). The length of time that the laser beam was applied to the pinna varied, depending on the thickness of the pinna. The laser tip was held 1-3 mm away from the tissue and operative time varied from 12 min to 20 min. Postoperatively, the pinna was flattened and immobilized with sterile gauze and over-the-head bandaging was applied in all the cases and it was changed weekly until the wound healed. All the animals were kept on antibiotic and anti-inflammatory drugs.

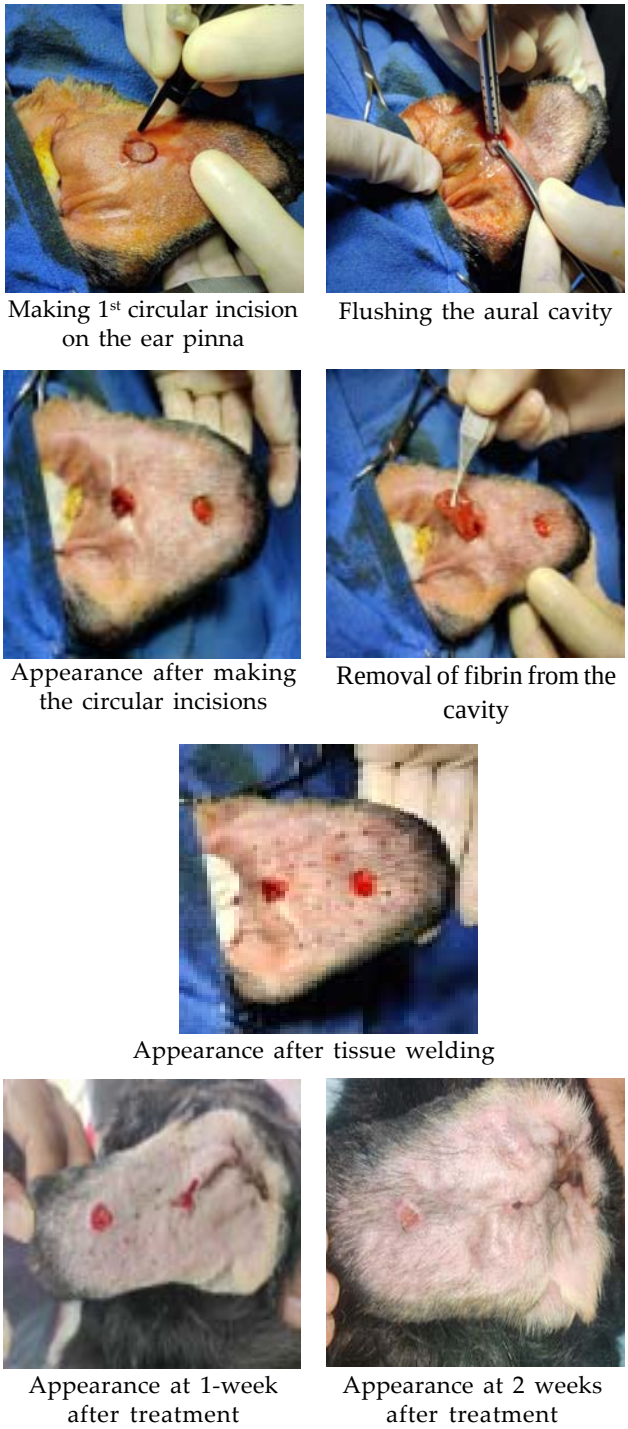

Fig. 1: Steps used for the treatment of aural haematoma.

Results and Discussion

Aural haematoma is the accumulation of blood in the ear between the cartilage and the skin (Kuwahara, 1986b). It is characterized as fluctuant swelling filled with haemorrhagic fluid, which is thought to come from the branches of great auricular arteries and veins within, under or between the

cartilage layers (Fossum, 2019). The pinna of a dog's ear is very much prone to traumatic agents i.e., external and internal. These agents may cause rupture of capillaries between the cartilages of the ear resulting in separation of the auricular cartilage and the skin. The specific source of haemorrhage is not known but it is supposed to originate from the branches of large auricular arteries and veins (Macphail, 2016). The exact cause of this condition is not well understood; however, numerous pathogenic processes have been hypothesized (Hall *et al.,* 2016). In many cases, it arises as a result of shear forces due to constant head shaking or ear scratching caused by pain or irritation due to otitis externa (Slatter, 2003). There are other postulated mechanisms of aural haematoma, including degenerative processes leading to the splitting of the auricular cartilage, increased capillary fragility and inflammatory immune-mediated processes that damage the auricular cartilage.

Out of 13 cases included in the study, nine were male and four were female, which corresponds to the reports of Ashwathkumar (2020) and Al Salihi and Kathem (2021) who have also reported that males were more prone and showed higher incidence of ear diseases than females. According to Terzier and Borissov (2018), males are more susceptible to aural haematomas, may be attributed to their higher activities like fighting and aggressive behaviour, which makes them more susceptible to pinnal injury by biting and chewing of the pinna. Furthermore, male hormones and androgen cause hyperplasia, and hypertrophy of sebaceous glands, which cause greater sebum production in the ear canal and that provides a favorable environment for microbes to multiply, leading to haematoma formation. Estrogens cause sebaceous gland degradation and decline in function, therefore, females may be at a lesser risk than males (Dezhang *et al.,* 2019). However, according to Moshin (2010), Hassan *et al.* (2002), Dye *et al.* (2002) and Feyisa *et al.* (2020), there was no evidence related to sex predisposition affirming the occurrence of aural haematoma. In the present study, the affected dogs belonged to an age range of 2-11 yr. Gyorffy and Szijarto (2014) and Lahiani and Niebauer (2020) reported a higher incidence of aural haematoma in the age group of 4-6 yr because this age group has aggressive nature and tend to do more outdoor activity, which may contribute in ear flap injury leading to aural haematoma. The cases of aural haematoma were more in German shepherd (6) followed by non-descript (4), Labrador (2), and Pitbull (1) breeds. These findings are similar to Dezhang *et al.* (2019), who have reported that German shepherd breed has violent temper, which makes them more susceptible to pinnal trauma. Additionally, presence of more hairs in the ear canal may hinder adequate aeration resulting in ear infection and pawing of the ear pinna, which causes cartilage fracture with chronicity of injury, causing further deposition of fibrin between the skin and the cartilage. Various etiological factors were recorded in the present study. The most common factor recorded was otitis externa (7), followed by trauma/injury (3), dermatitis (2) and ectoparasites (1). Similar findings were also reported by Donekar *et al.* (2016). All the clinical and haematological parameters were within the normal physiological limits, which corresponds to the study of Reddy and Kumar (2020).

All the cases were managed surgically by the use of CO_2 laser-assisted leather punch technique. CO_2 laser power ranging from 10-12 Watt in continuous mode was used to make two circular incisions on the most dependent parts of the concave surface in order to facilitate drainage. Kibson *et al.* (2022) also used CO_2 laser in continuous mode with 10 Watt power for making circular incisions. Several focal tissue welding incisions using laser power ranging from 8-10 Watt in CW mode were made with the intention of stimulating adhesion between the two cartilage layers. Tissue welding creates immediate bonds between the tissue layers as the laser energy is reported to lyse the collagen bonds between the tissue which then reforms during tissue cooling and cause binding of the tissues together (Fried and Walsh, 2000). Dye *et al.* (2002) also stated that the length of the time the laser beam was applied and the laser power depended upon the pinnal thickness. The healing period in all the cases ranged from 10-15 days (Table 1) with good to excellent outcome. It was observed that the time taken to heal the incisions was somewhat longer in cases where fibrosis was present and slightly higher power was used. This is in accordance with Mungmee and Sattayut (2023), who have observed that higher power settings resulted in more extensive and deeper tissue ablations, indicating substantial thermal damage and increased carbonization at higher power settings, thereby delaying the healing time. Postoperatively, all the cases recovered uneventfully with no complications observed in any case during the study period. The use of the CO_2 laser leather punch technique offers advantages such as faster healing with less chance of scarring and thus prevents ear blemishes. All the cases had a good to excellent cosmetic outcome. Similar findings were reported by Dye *et al.* (2002) who have reported that this treatment was effective and caused minimal tissue scarring in pinna with excellent cosmetic outcome.

Based on the results of the present study, it was concluded that the CO_2 laser appears to be a satisfactory method for the treatment of canine aural haematomas. There is minimum operative time and it results in good to excellent cosmetic outcomes. Management of aural haematomas with CO_2 laser offers advantages such as faster healing, minimal scarring, better outcomes without recurrence.

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