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CASE REPORT

Companion or pet animals

Successful management of canine (*canis lupus familiaris*) mandibular osteolytic chondroma with electrochemotherapy

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Abstract

In recent years, electrochemotherapy has gained relevance in veterinary oncology for the treatment of locally invasive superficial tumours in dogs, such as mast cell tumours, perianal neoplasms, soft tissue sarcomas, oral squamous cell carcinomas and melanomas. Although chondromas are generally benign, their progressive growth can cause significant anatomical and functional impairments. When located in the mandible, traditional treatment often involves rostral mandiblectomy, which may lead to postoperative sequelae, affecting the animal's quality of life. In this case, electrochemotherapy with bleomycin was well tolerated and achieved effective local tumour control with a single session, without the need for invasive surgery. To the best of our knowledge, this is the first clinical report describing the successful use of electrochemotherapy as a sole therapy for a mandibular chondroma in a dog. This study aimed to explore electrochemotherapy as a less invasive alternative for managing this tumour.

KEYWORDS

canine neoplasm, chondroma, electrochemotherapy, mandible tumour, neoplasia

BACKGROUND

Chondromas are mesenchymal (connective tissue) tumours originating from cartilage, and they are typically benign in nature.[1–4] These neoplasms are composed of mature hyaline cartilage.[1–4] Primary bone chondromas are classified as enchondromas or ecchondromas.[1–3] Enchondromas develop within the bone marrow cavity,[1–3,5] whereas ecchondromas arise from cartilage located elsewhere in the skeleton.[1–3] In domestic animals, chondromas are uncommon,[5–11] although they have been most frequently documented in older dogs and sheep.[7] No specific breed or sex predisposition has been reported.[1–3] This case concerns a female bull terrier diagnosed with a right rostral mandibular chondroma. Unlike prior reports, the mass in this patient was identified on the right rostral aspect of the mandible.

The purpose of this study was to assess the effectiveness of electrochemotherapy (ECT) as the sole treatment for mandibular chondroma, offering an alternative when surgical resection and/or radiotherapy are declined by the owner or not feasible.

CASE PRESENTATION

A 10-year-old, neutered, female bull terrier was presented because of a mandibular lesion. The results of physical examination of the patient were unremarkable, except a mass protruding from the rostral mandible. The mass had been present for 2 years and had been slowly growing during this time. Initially, the mass did not seem to bother the patient, but lately, when the patient ate, it shifted food away from the oral mass. The mass was solid and firm, proliferative, with poorly well-defined borders, composed of non-pigmented gingival tissue with ulceration on its surface. Blood and sensitivity to pain were observed after the examination. The mass was approximately 5 cm long (from left to right side of the mandible), 3.5 cm wide (from rostral to caudal) and 2 cm high (from ventral to dorsal). Affected teeth involved by the mass were the six incisors of the lower arch (I1, I2, I3 left side and I1, I2, I3 right side) (Figures 1 and 2). The patient was staged by a complete physical examination.

INVESTIGATIONS

Staging included complete blood cell count, biochemistry profile, urinalysis, radiographs (three-view thoracic, from cranium and facies), electrocardiogram, echocardiogram, abdominal ultrasonography and computed tomography. Results of preanaesthetic blood testing were largely within reference limits, and the patient was anaesthetised for diagnostic imaging techniques and excisional biopsy. The final diagnosis was obtained by the histological examination.

FIGURE 1 Picture of the mass in the apical side of the mandible, with the teeth. Ulceration of the mucosa overlying the mandibular tumour can be seen.

FIGURE 2 Photograph from the lateral view of the mandible (right) with erosion on the lower side.

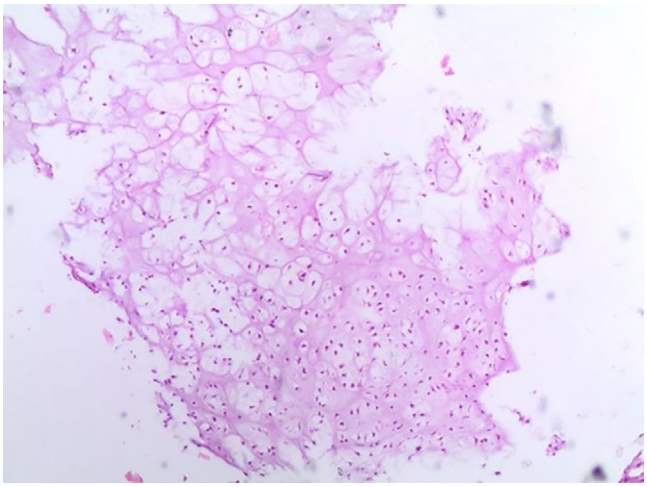

FIGURE 3 Photograph (40×) of the histological sections showing dense and compact collagenous matrix that presents wide areas of differentiation towards the production of a basophilic cartilage matrix that is associated with a predominant number of cellular elements with typical characteristics of chondrocytes.

Results revealed a mesenchymal neoplastic proliferation that showed differentiation towards the formation of mature chondroid tissue (Figures 3 and 4). The tumour appeared to be made up of a dense and compact collagen matrix, which presented wide areas of differentiation towards the production of a basophilic cartilaginous matrix associated with a proliferation of cellular elements with typical chondrocyte characteristics. Thus, these cells were organised into small clusters occupied by one to three cells with rounded vesicular nuclei, sometimes showing a prominent nucleolus. The degree of cellular atypia was low without observing mitotic figures.

Diagnostic imaging of the head showed a moderate destruction of the right mandible (Figures 5 and 6).

LEARNING POINTS/TAKE-HOME MESSAGES

- In conclusion, electrochemotherapy may represent a valuable therapeutic option for benign yet locally invasive oral tumours such as chondromas, including those with associated osteolysis. Its minimally invasive nature and limited systemic side effects make it particularly suitable in clinical scenarios where hemimandiblectomy, radiotherapy or both are not viable.
- Based on our extensive clinical experience and case evaluations, electrochemotherapy allows for the preservation of anatomical structures and essential functions such as eating and drinking, minimising the need for mutilating procedures and reducing the risk of post-treatment complications typically associated with more aggressive approaches.
- Additionally, evidence from human medicine supports its potential in reducing tumour-related pain, especially in osteolytic lesions, adding a significant palliative benefit. While further studies are needed to fully define its role, electrochemotherapy stands out as a well-tolerated and function-sparing alternative worth considering in selected veterinary cases.

TREATMENT

The owner of the patient refused the surgical and radiotherapy treatment, which consisted of a rostral bilateral mandibularec-

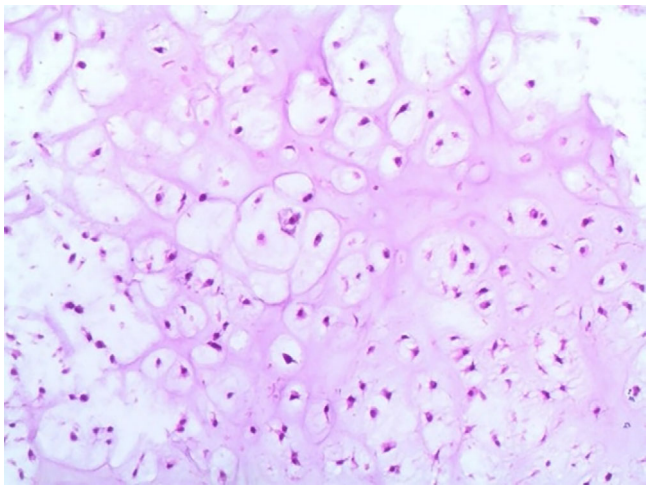

FIGURE 4 Photograph (100×) of the histological sections showing dense and compact collagenous matrix that presents wide areas of differentiation towards the production of a basophilic cartilage matrix that is associated with a predominant number of cellular elements with typical characteristics of chondrocytes.

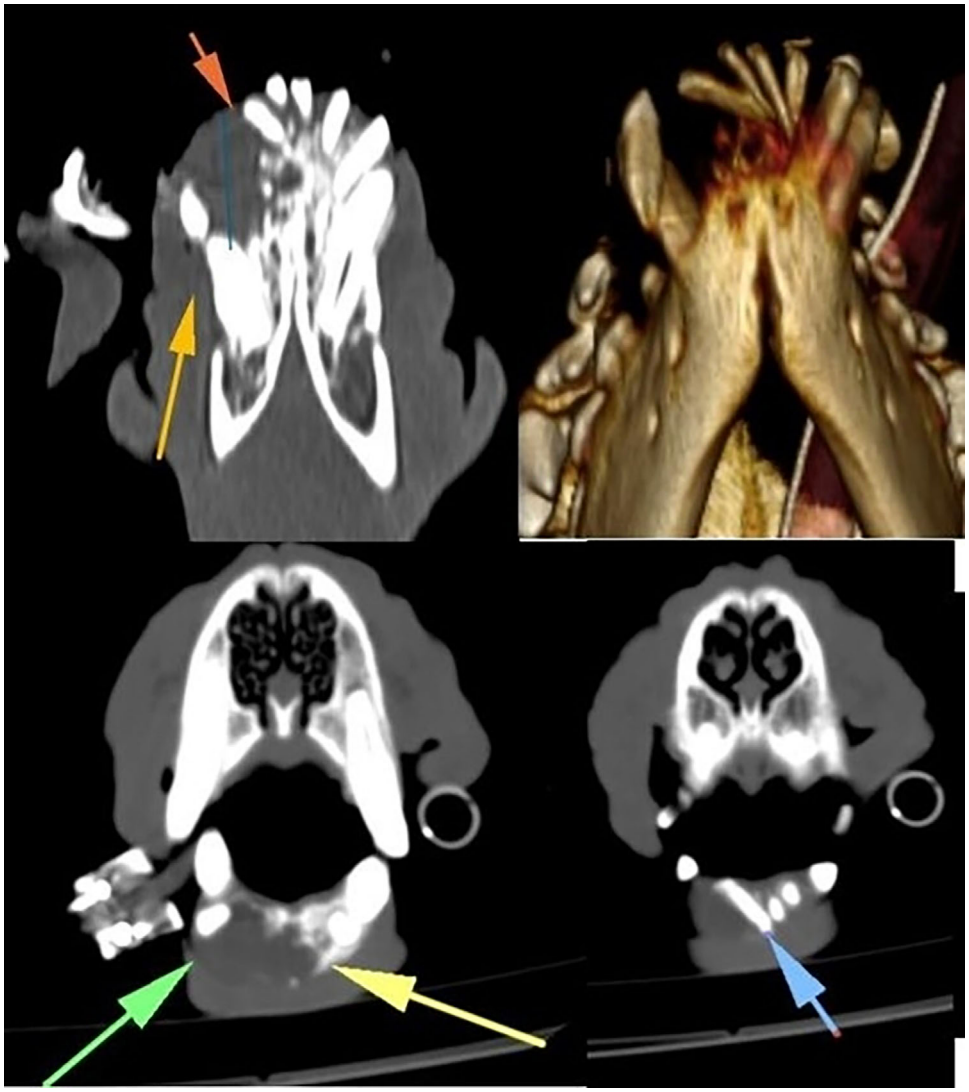

FIGURE 5 Picture of the computed tomography showing the side with osteolysis produced by the mass injury.

FIGURE 6 Radiography of the cranium and facies, including the apical portion of the mandible with osteolysis.

tomy. It was proposed to apply the ECT with bleomycin. An automatic electroporator Electrovet EZ V3.0 alternating current model (Leroy Biotech) was used for this procedure. It emits unipolar square wave pulses in groups (trains) of eight pulses of 1000 V/cm, 100 μs, 20 A and 10 kHz frequency. The cytostatic drug used was bleomycin with a concentration of 1500 IU/mL. It was administered intravenously, diluted with sterile physiological saline in a 1:3 ratio. The dose was 15,000 UI/m^2 (based on the guidelines). The electrode used comprised 8 parallel needles of 15 mm in length and a separation of 8 mm between needles. The diameter of the needles was 0.68 mm. Before the intervention, they were administered intramuscular dexamethasone to avoid a marked inflammatory response. A single dose of 0.15 mg/kg was used. The ECT was administered with general anaesthesia; previously, sedation with medetomidine hydrochloride (50 mcμ/kg, Medetor 1 mg/mL, injectable solution, CP-Pharma) was used. The medetomidine was combined with metadone hydrochloride (0.02 mL/kg, Metasedin 10 mg/mL injectable solution, Esteve Pharmaceuticals) and with midazolam (0.01 mL/kg, Midazolam 15 mg/3 mL, injection solution, Laboratorio Reig Jofre). These three drugs were administered together intramuscularly. After sedation, an intravenous catheter was placed in

FIGURE 7 Photograph of the treatment with the electrodes applied and introduced into the tumour.

one of the extremities for the administration of propofol, bleomycin and maintenance serum therapy. The same venous access was used for all medication and crystalloid infusion. Induction was performed with propofol (0.2 mL/kg, intravenously, Propovet multidosis 10 mg/mL, injectable emulsion, Zoetis, Madrid). After that, the patient was intubated and connected with the isoflurane machine at a dose of 2%. Once the animals were in a good anaesthetic plane, they were administered bleomycin diluted in physiological saline for approximately 2 minutes. After the complete injection, ECT was started 8 minutes after bleomycin had been administered, and the electrical pulses were applied through the electrodes (Figure 7).

OUTCOME AND FOLLOW-UP

The clinical controls were performed every week for the first 4 weeks, then every 15 days, to measure the tumour. Oral radiograph control was performed at the 8th week, and the next follow-up was done by phone calls to the owner of the patient at 3 and 6 months, and no swelling or bleeding in the region was reported.

Clinical signs are associated with the size and localisation of the tumours. In this case, the mass was ulcerated, and after the ECT and introduction of analgesic and oral NSAID treatment, the animal showed signs of improvement. During the patient's clinical examination, swelling, ulceration, bleeding and pain in the mandible were observed before the ECT treatment. The surface of the treated area presented necrotic tissues (Figure 8) during the first week. Following the ECT, the patient had no bleeding, better appetite since the first week, and swelling was reduced at the same time as the size of the tissues that made up the mass. A progressive reduction was observed until an almost normal contour of the mandibula was achieved 2.5 months after the intervention (Figure 9). The teeth affected and trapped by the mass began to be exposed.

FIGURE 8 Picture of the lesion after the first week of the electrochemotherapy with the necrotic tissues and swelling of the treated zone.

FIGURE 9 Image of the jaw of the patient at 10 weeks after the treatment. The teeth were lost, and no ulcer or lesion was present.

Clinically, the patient returned to normal eating and drinking and exhibited normal occlusion.

DISCUSSION

Chondromas are considered rare entities in domestic animals, a fact consistently supported by the available literature and documented case reports.[1–6,8–11] The present description concerns a lesion arising in an atypical location. Both the gross and histopathological characteristics of this tumour were in line with those reported previously.[3,8] In this anatomical region, distinguishing chondromas from other conditions such as epuli, traumatic lesions or chondrosarcomas may be problematic. Nonetheless, certain features—including increased cellularity, the presence of binucleated or multinucleated chondrocytes, pleomorphism and mitotic activity—are more typical of chondrosarcomas and aid in differentiation.[1,2]

Histopathological descriptions in previous studies indicate that these tumours are often organised into irregularly distributed lobules. The neoplastic cells generally consist of well-differentiated chondrocytes, relatively uniform in shape and size, showing ovoid, pleomorphic or pyknotic nuclei surrounded by vacuolated cytoplasm. The tissue usually displays poor vascularisation and may contain limited foci of necrosis. Mitoses are typically absent in these cells. Chondromas therefore consist of lobules of hyaline cartilage, with tumour cartilage composed of chondrocytes that remain fairly consistent in morphology and are embedded in a matrix that occasionally exhibits a greater proportion of fibrous stroma compared to normal hyaline cartilage.[1–3,6,11]

Although such lesions may attain a considerable size, they often remain asymptomatic or present as painless swellings.[1,3] Their growth is characteristically slow, usually leading only to minor bony changes or distortions.[1,2,12]

ECT with bleomycin[12] has been recognised as an effective treatment option for several neoplastic conditions in both veterinary and human patients, including squamous cell carcinoma,[13] melanoma,[14] soft tissue sarcomas, injection site sarcomas (ISS), mast cell tumours,[15] localised cutaneous lymphoma, plasma cell tumours, perianal neoplasms, epulis and equine sarcoids.[12,16] To date, however, no other case has been published describing successful management of an osteolytic oral chondroma exclusively with ECT.

One of the main clinical advantages of ECT lies in its minimally invasive approach. Unlike traditional surgery, such as hemimandiblectomy, the procedure does not require major incisions, extensive tissue removal or reconstructive efforts. This makes it particularly useful in maintaining the structural and functional integrity of the oral cavity, reducing the risk of postoperative complications that interfere with eating or drinking. Compared with radiotherapy, ECT avoids adverse effects, including mucositis, xerostomia and delayed wound healing, thus providing a more favourable recovery period for patients.

It is important to emphasise that ECT should not be regarded as a complete replacement for surgery or radiotherapy; rather, it represents a valuable alternative or complementary option, especially in geriatric animals or when conventional therapies are declined or contraindicated.[17,18] Although ECT cannot reverse existing bone lysis, it is capable of achieving local disease control and significantly contributes to pain relief. Evidence from human oncology has shown that ECT can markedly reduce tumour-associated pain, particularly in osteosarcoma patients.[19,20] This benefit is thought to result from both tumour volume reduction and attenuation of local inflammatory processes and can reasonably be extrapolated to veterinary patients suffering from oral tumours with osseous involvement.

In the present case, the treated dog exhibited no signs of pain, haemorrhage or feeding difficulties during the 6-month follow-up period. Haematological and radiographic evaluations remained stable, with no indication of tumour recurrence. These outcomes support ECT as a safe, well-tolerated and function-preserving therapeutic option, capable not only of controlling local progression but also of enhancing the patient's quality of life through effective analgesia.

AUTHOR CONTRIBUTIONS

Both authors conceived, designed and contributed to the project.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FUNDING INFORMATION

No sources of funding (institutional, private or corporate financial support) were received for the paper or the animal treatment.

ETHICS STATEMENT

In regard to this case report, we respect the rights, dignity and welfare of the animal and always with pain control, with the owner's consent about all the procedures.

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OWNER'S PERSPECTIVE

Initially, the owner was not familiar with this treatment, but all available options were thoroughly explained. By the end of the follow-up, the owner reported that the treatment was easy to manage and resulted in a good and rapid recovery. She chose this option from the beginning, as she declined hemimandiblectomy and radiotherapy, and expressed great satisfaction with her decision.