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OUTCOME OF 2 CATS WITH SQUAMOUS CELL CARCINOMA TREATED WITH 1 ½ MANDIBULECTOMY

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Abstract

The objective is to describe the outcome and complications of two cats treated with a hemi plus rostral part contralateral mandibulectomy (1 ½ mandibulectomy) technique for the management of oral squamous cell carcinoma (SCC) with bone infiltration. Mandibulectomy can be performed in cats but unlike canine patients, they may require additional supportive care. Two cats were presented for progressive mass growing on the mandible. Both had bone invasion and were diagnosed with SCC by biopsy examination. The procedure involved a left/right mandibulectomy and the rostral part of the right/left hemimandible caudal to the lower canine tooth (1 ½ mandibulectomy), at least 1 cm far from the macroscopically visible lesions. Both cats had feeding tubes placed. The surgical outcome for one of the two cats was excellent, surpassing 302 days of survival, the other cat did not regain the ability to eat and the owners opted for euthanasia 35 days after surgery. Both histopathological reports confirmed SCC and clean margins. The hypothesis of the study reported here was that 1 ½ mandibulectomy would be effective for control of superficial subcentimetrical, caudal to the canine tooth oral SCC with bone invasion in cats but could also lead to permanent loss of feeding function and compromised quality of life.

Key words*: squamous, carcinoma, mandibulectomy, surgery, cats.*

INTRODUCTION

The most frequent oral neoplasia in cats (60-70%) (Stebbins et al., 1989) is feline squamous cell carcinoma (SCC), which is often found in older cats with a median age of 15 years (Bregazzi et al., 2001). The usual tumour sites are the mandible, maxilla and tongue. Bone involvement is common and frequently extensive in both the mandible and maxilla (North & Banks, 2009). While some cats present with visible oral masses, many are seen due to secondary clinical signs, such as ptyalism with bloody, foul-smelling saliva and dysphagia (Snyder, 2012). It is often difficult to determine the true extent of these tumors through physical examinations due to their invasive nature.

The development of oral cavity tumors in dogs and cats has been linked to nutritional and environmental variables, flea collars, and passive smoking (Mikiewicz et al., 2019). Local tumour control is poor, regional lymph node and distant metastases are uncommon and the long-term prognosis is uncertain because the majority of patients are euthanized due to the disease's progression. Regional lymph nodes may be enlarged when a patient first presents, however, they are often hyperplastic because of the production of inflammatory cytokines (North & Banks, 2009).

The overall prognosis for oral SCC is poor. Despite various multimodal therapy approaches, responses are typically only partial and temporary and overall survival continues to be only a few months (Marconato et al., 2020). The treatment of feline oral SCC is difficult, as few therapies (or combinations of therapies) have shown success. The median survival time for feline patients who receive no treatment is only 60 days (North & Banks, 2009). Surgical excision of the visible tumour only rarely results in a prolonged lifespan. The median survival period is extended to only 5 months after a mandibulectomy (Snyder, 2012).

Surgical excision with safety margins is the usual approach to treatment for small tumours of the mandible and maxilla (Murphy, 2016). Early identification of oral SCC in cats is the most significant prognostic indicator whilst they may still be candidates for surgery. Unfortunately, SCC is often advanced when it

is diagnosed, making surgery challenging (Moore & Moore, 2009)

The treatment of choice in oral feline SCC is surgery. A variety of procedures were explored most of which were unsuccessful before the onset of aggressive surgical procedures. Oral tumour survival rates have increased as a result of aggressive surgical resection techniques such as mandibulectomy and maxillectomy (Birchard & Carothers, 1990). More than 1 cm of surgical margins is ideal, however, they are difficult to obtain due to the small feline craniofacial dimensions (Bilgic et al., 2015).

Although mandibulectomies can be performed in cats, they often do not handle the procedure as well as canine patients and may need additional postoperative assistance (Northrup et al., 2006). However, they are frequently unable to feed in the early postoperative period. In order to control this aspect, it is indicated to routinely insert a gastrostomy tube at the time of surgery (Berg, 1998).

This paper aims to describe the procedure, complications and long-term outcome of 2 cats that underwent a 1½ mandibulectomy technique for managing oral SCC with bone infiltration.

MATERIALS AND METHODS

Patients and tumor characteristics

The medical records (May 2021-May 2023) of cats that were presented in our clinic for surgical treatment of oral SCC were reviewed. We considered cases that underwent 1½ mandibulectomies. The cases were selected based on tumour type, size, location of the mass, and degree of bone involvement. Clinical staging for regional and distant metastasis consisted of physical examination, routine complete blood count and serum biochemistry and thoracic and head radiography. The thorough analysis of medical records granted for the collection of additional information, including signalment (breed, age, sex, and weight), concurrent diseases, involved site, tumour size, clinical stage, treatment-related side effects or complications, time and cause of death and date of the most recent follow-up visit.

Case description

Two cats, domestic short hair, were referred for progressive mass growth on the mandible, caudal to mandibular canine teeth. Cat no. 1 is a spayed female, 4 kg body weight, 14 years old, right side previous local biopsy performed. Cat no. 2 is a neutered male, 5.4 kg body weight, 13 years and 10 months old, left side previous biopsy performed. Both biopsy pathology results confirmed SCC. Both cats presented radiological bone involvement. Ptyalism and halitosis were the two most frequent complaints, one of the cats was also showing signs of hyporexia while the other had no change in appetite. At the time of presentation, both cats were in good body condition.

Staging

On diagnostic imaging, both presented bone invasion of the mandible. There was no evidence of distant metastasis. Negative submandibular lymph node involvement with the cytological examination. Three-view thoracic radiographs were also performed for comparison at the time of subsequent follow-up. Both cats were diagnosed with SCC by biopsy examination. The remainder of the clinical examination was unremarkable, with no peripheral lymphadenopathy.

Surgical technique

Examination of the oral cavity under general anesthesia revealed a firm mass that was deforming the right/left ventral aspect of the mandible with the implication of the oral cavity floor and an obvious involvement of the median line, towards the right/left side (Figures 1, 2). Superficial proliferative/ulcerative lesions were caudal to the canine tooth extending towards premolars. Surgery includes right (cat no. 1)/left (cat no. 2) mandibulectomy, at a distance of at least 1 cm caudal to the macroscopic process observed, resulting caudal to the molar, en-bloc resection with skin tissue, and inclusion of the rostral portion of the left (cat no. 1)/right (cat no. 2) hemimandible, behind the canine tooth (Figures 3-8). Osteotomy is achieved with Liston bone cutter forceps, allowing control of hemorrhage by early identification of mandibular canal vessels and bipolar usage. Radiological evidence of complete excision is obtained postoperative and the histopathological examination confirmed it (Figures 9-11). Both cats had feeding tubes placed before surgery termination.

Figure 1. Preoperative image of cat no. 1. The cat is in dorsal recumbency

Figure 2. Preoperative image of cat no. 2. There is a large, firm mass of the ventral ramus of the mandible

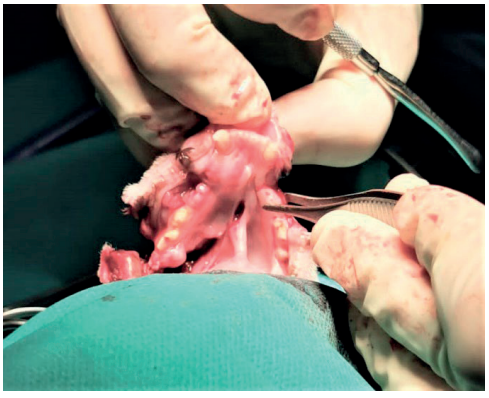

Figure 3. Intraoperative image of cat no. 2. The mass was about to be removed

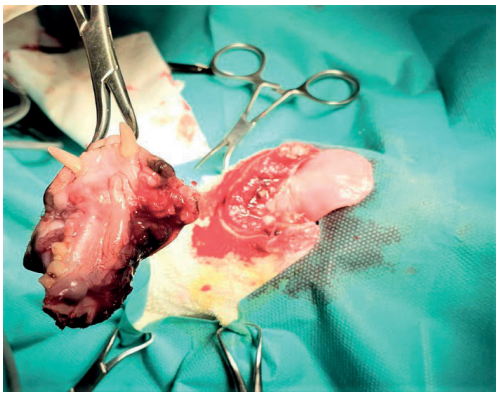

Figure 4. Intraoperative image of cat No.2. The mass was detached

Figure 5. Postoperative image of the removed mass in cat no. 1

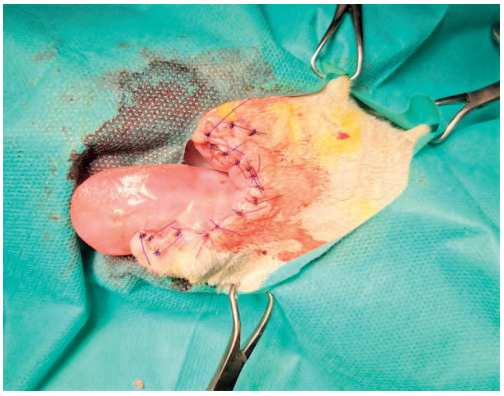

Figure 6. Postoperatively image cat no. 2 after the mass was removed

Figure 7. Postoperatively image cat no. 1 after the mass was removed

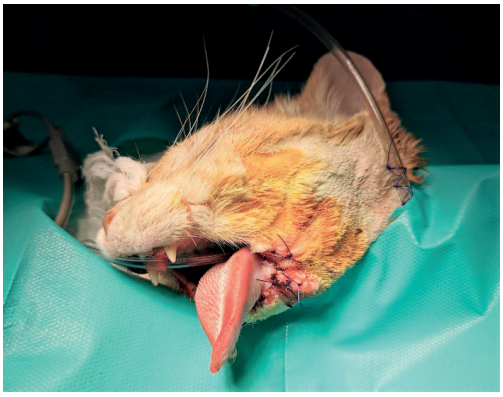

Figure 8. Postoperatively image cat no. 2 after the feeding tube was placed

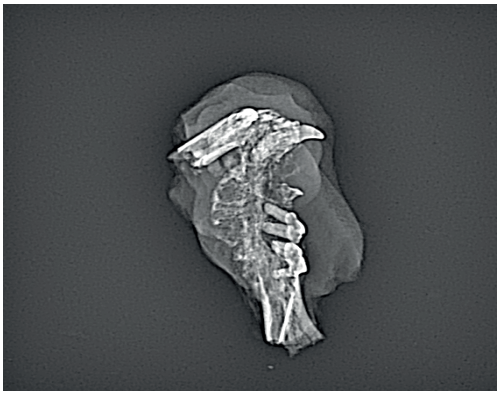

Figure 9. The radiological aspect of the excised mass in cat no. 1

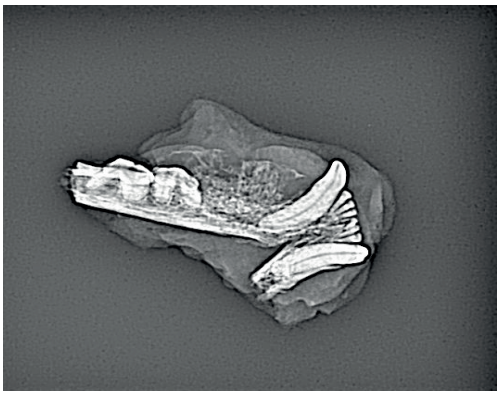

Figure 10. The radiological aspect of the excised mass in cat no. 2

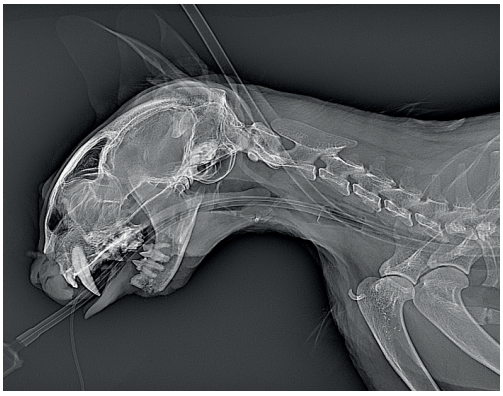

Figure 11. The radiological aspect of cat no. 2 postoperatively

RESULTS AND DISCUSSIONS

Complications

The biology of the SCC implies an increased risk of recurrence and a lower risk of metastasis.

Cats with extended mandibulectomies may develop persistent anorexia as a result, leading to constant feeding assistance.

Considering the extent and nature of the local disease, the need for major intervention, the expected local and general complications and the increased risk of recurrence, the prognosis is poor.

This type of extended intervention involves a difficult-to-predict long-term postoperative evolution, but it is expected that numerous complications and changes in the general condition will occur, with the possibility of other interventions to control local

complications, especially dehiscence over osteotomy sites or high-tension suture points. Another series of complications derive from the mandibular drift and food/debris accumulation on the dental surface along with abundant plaque formation. Also one can observe the hanging tongue.

In the case of persistent local and general complications, without a tendency to reduce and adapt to the new condition, the prognosis is unfavorable.

Possible local complications expected include local inflammation, dehiscence, exposure of bone edges, salivary cysts, hypersalivation, poor cosmesis, permanent anorexia, constant vomiting, ptyalism, dehydration, pain, severe depression, the inability to control and achieve prehension with the tongue and groom voluntarily, behavioral disorders. As for infection, the area is well vascularized and, generally, the risk is low after this surgical procedure.

The complications encountered in both cats were represented by hypersalivation, difficulties in prehension and dehiscence with the exposure of the mandibular edge (Figures 12-14).

Cat no.1 also presented anorexia, exudative inflammation at the level of the esophagostomy site, reduced right paramedian sublingual salivary cyst, 1-2 millimeters dehiscence with a tendency for circumferential granulation and exposure of the mandibular branch, discomfort upon swallowing and elimination of a significant part of the nutritional support orally.

Figure 12. Postoperatively dehiscence with bone exposure in cat no. 1

Figure 13. Postoperatively dehiscence with bone exposure in cat no. 1

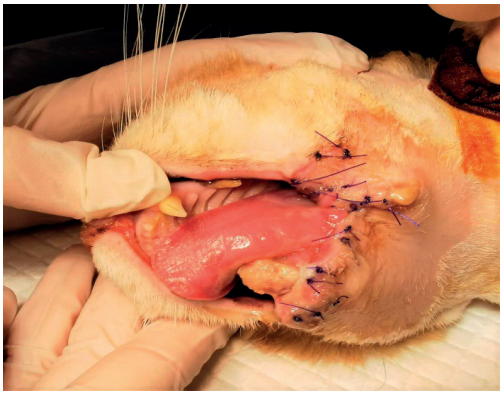

Figure 14. Postoperatively dehiscence with bone exposure in cat no. 2

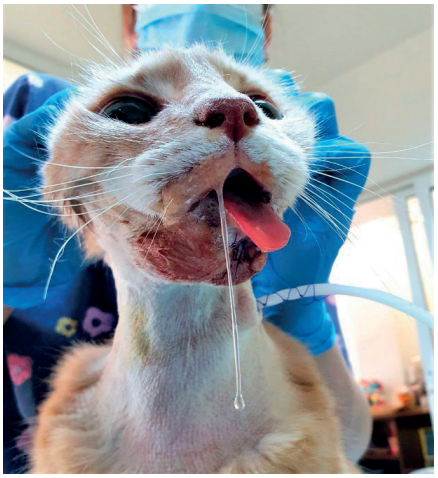

Figure 15. Postoperatively hypersalivation in cat no. 2

Postoperative management

Both cats required systemic antibiotherapy consisting of amoxicillin-clavulanate in a dose of 8.75 mg/kg/day for 14 days (Synulox RTU 100 ml, Zoetis, Belgium).

The analgesia protocol included robenacoxib in a dose of 2 mg/kg, daily for 14 days (Onsior 20 mg/ml, Elanco, France) and buprenorphine in a dose of 0.02 mg/kg, every 8-12 hours for 5 days then every 12 hours at the dose of 0.01 mg/kg for 14 days (Bupaq 0.3 mg/ml, Richter Pharma, Austria).

The esophagogastric tube was used to support caloric intake when there was no tendency for voluntary feeding. The possible complications regarding the feeding tube were inflammation at the place of placement, loss of permeability, migration or rejection due to severe stress, or repeated vomiting. It was estimated that the postoperative critical period is 2-3 weeks.

Cat no. 2 showed interest in food the day following the surgical procedure and 10 days later was consuming food voluntarily. The feeding tube was removed 14 days following the surgical intervention.

A unidimensional descriptive scale was used to accurately assess pain in order to provide targeted postoperative pain treatment (Gruen et al., 2022).

Cat no. 1 required additional analgesia and daily supportive treatment for the first 5 days after surgery, then every 2 days for up to 3 weeks.

The aspects related to the surgical area were manageable locally and did not require additional surgical interventions (Figure 16).

Figure 16. Postoperatively aspect in cat no. 2

The cat appeared interested in food but freely ingested insufficient amounts and refused to be force-fed after the feeding tube was withdrawn three weeks following the procedure.

The ability to eat on his own (cat no. 1) was only partially restored, requiring additional food intake provided by the owners and despite the supportive treatment he was receiving daily in the clinic.

Outcome

The surgical outcome for one of the cats was excellent (cat no. 2), independent food intake was achieved the next day after surgery and the feeding tube was removed two weeks later.

There were no major complications related to the surgery or tumour recurrences during the 302-day follow-up (Figures 17, 18).

The other cat did not regain the ability to eat and the owners opted for euthanasia 35 days later.

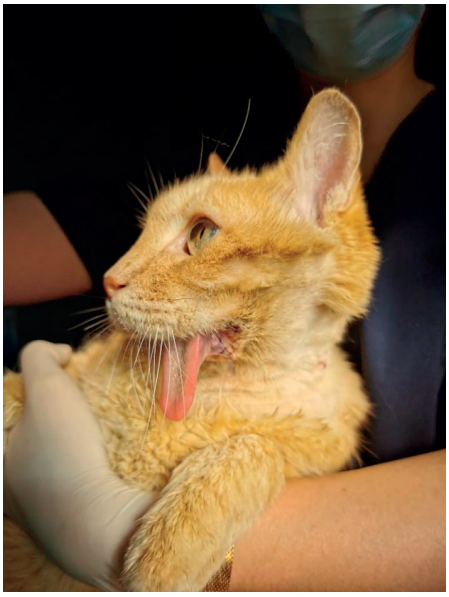

Figure 17. Cat No.2 at 4 weeks follow-up visit

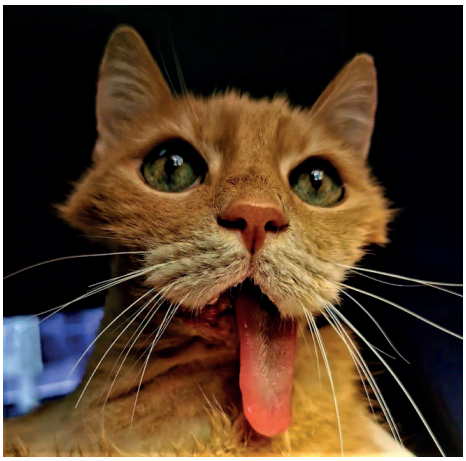

Figure 18. Cat no. 2 at 4 weeks follow-up visit

Discussions

The excision of oral neoplasia is the most common reason for mandibulectomy in cats. Techniques regarding mandibulectomy vary according to the extent of the disease and the surgeon's preferences. In cats, mandibulectomy is relatively rare, partly because the available research suggests against it (Northrup et al., 2006).

The intent of both surgeries was curative and clean margins were histologically confirmed in both cases. A cure can be achieved if clear surgical margins are obtained and the procedure is well tolerated by the cats (Boston et al., 2020).

Feeding tube placement is recommended in all cases of feline mandibulectomy due to the unpredictable intervals between surgical procedures and the willingness of cats to eat voluntarily. In this study, the time frame ranged from two days to two weeks. Owners were informed that postoperative feeding tube assistance was necessary and could be permanent with both cats eventually maintaining their nutritional requirements orally.

Northrup et al. (2006) published a case series involving 42 cats of which 17 had feeding tubes placed at the time of the survey, yet 29 cats showed anorexia in the postoperative period. This underlines the need for vigorous supportive treatment in cats undergoing mandibulectomy and may have contributed to some of the study's poor outcomes (Northrup et al., 2006). It was presumed that mandibulectomy would not achieve local control of most tumors because most feline oral tumors are locally invasive and performing a more aggressive mandibulectomy procedure would result in a permanent loss of basic oral functions and a compromised quality of life.

According to Northrup et al., six cats were treated with radical mandibulectomy, of which three did not fully regain complete oral feeding. In a retrospective study of 8 cats, independent food intake was achieved in 6 cats following radical mandibulectomy and four cats lived longer than one year (Boston et al., 2020).

With a median progression-free interval of nearly 1.5 years, tumor control for the majority of the cats in the Northrup et al. study was remarkably good in contrast to the anticipated result. For cats with SCC, osteosarcoma and fibrosarcoma, the survival rates 1 year after surgery were the same as those 2 years post-intervention, indicating that if a cat lived for 1 year, there was a good probability of long-term survival. The majority of owners (>80%) expressed satisfaction with the outcomes despite the complications implied with mandibulectomy in cats (Northrup et al., 2006).

Wound dehiscence following a mandibulectomy, particularly at the alveolar margin, may occur over the rostral end of the osteotomized mandible, exposing bone. While larger areas might require being surgically debrided and closed, smaller areas of dehiscence may heal by second intention (Verstraete, 2005).

Cats with mandibular SCC who underwent mandibulectomy as sole treatment had a median disease-free interval of 340 days, compared to 911 days for rostral tumours. Unfortunately, just a few patients can benefit from surgical removal with clean margins (North & Banks, 2009).

Partial mandibulectomy or maxillectomy should only be used to treat small tumours as larger tumours or those with insufficient resection margins will require radiotherapy in addition to surgery (Bilgic et al., 2015).

In a retrospective study on 8 cats, the estimated mean survival time was 712 days with three long-term survivors that died of causes unrelated to their main disease. The majority of them underwent radical mandibulectomy to treat extensive oral neoplasia and the procedure

was not associated with poor functional outcomes or significant morbidity during the postoperative period (Boston et al., 2020).

The authors would also like to add that the number of papers regarding the outcome of cats following radical 1 and ½ mandibulectomies is reduced and data from our small study may humbly contribute to the general knowledge regarding the subject. We acknowledge at the same time the small number of cases, only 2 cats, with low statistical power. Although, we learned that client education, owner decision and compliance, early detection of disease and good case selection are paramount for a positive outcome. We may also add that prior surgical visits consisted also of questions about the feeding habits of both cats. Subjectively, based on owners' reports, there was a difference between the two cats. Cat no. 1 reported a more reluctant feeding habit while cat no. 2 had a reported enthusiastic feeding habit, confirmed after surgery. Cosmesis is a subjective issue also and in the case of cat no. 1 is poor while in the case of cat no. 2 is good. We also assessed the quality of life (QOL) as reported by owners and the difference was positively in favour of cat no. 2, doubled by good client satisfaction. Also, on the subjective side, we observed another difference in terms of self-grooming. While cat no. 1 was unable in the first period and only attempted/initiated but did not continue the grooming later after surgery, cat no. 2 was on the opposite side, grooming voluntarily and with relative ease in the postoperative period.

Cat no. 2 survives to date and is disease free, 302 days after surgery. Cat no. 1 survived 35 days, euthanasia by the owner's decision.

Both surgeries resulted in confirmed clean margins. Both cats presented dehiscence over the osteotomy mandibular site in the first 7 days after surgery. Both healed by the second intention. Both cats presented postsurgical submandibular oedema, ptyalism and reduced salivary cysts, which healed spontaneously. Local inflammation is normal after surgery and no sign of local infection was observed in both cats. Cat no. 1 had a low tolerance for the feeding tube, needed frequent position adaptation in the distal oesophagus. On the first day after surgery, the cat vomited and stopped after tube repositioning. Cat no. 1 also presented with exudative inflammation at the esophagostoma site.

It may well be a truism but is worth mentioning that even with small superficial appearances, SCC requires extensive excisions compared to cranium dimensions in cats as well as harbouring bone invasion and extensive profound soft tissue involvement potentially compromising surgical margins. We can say that even with small, in terms of millimetres surface lesions such as SCC, radical surgery is required for the cure, being the case for both cats. As an example, in the case of cat no. 2, the pathology report measured a superficial proliferative-ulcerative lesion of 2/6 mm, between the left canine tooth and the first premolar. It is our opinion, based on our two cases that even with early detection of subcentimetrical superficial lesions the surgical dose could extend to radical 1 and ½ mandibulectomy in cats with the condition of the lesion being located in the rostral part, particularly caudal the canine tooth.

CONCLUSIONS

Mandibulectomy for the management of canine oral tumors has been extensively documented in terms of outcomes and owner satisfaction. In contrast with this, a literature search revealed much less information regarding the outcome of this surgical procedure in cats.

Even though a significant part of bone and soft tissue is usually removed, function and appearance are acceptable. While common, postoperative complications are usually manageable. The early detection of SCC in cats is crucial for establishing a suitable approach in order to achieve long-term survival. Mandibulectomy may be considered in combination with postoperative aggressive pain control and feeding tube management as a treatment option for cats with extensive mandibular neoplasia.

Literature research has been performed on articles concerning mandibulectomies in cats and 30 articles were found. Out of them, 3 articles were assessing the outcomes of the cats that underwent this surgical procedure. The small number of subjects in our study is one of its limitations.

Considering the limited information available on cats treated with 1 ½ mandibulectomy, the locally invasive nature of SCC and the small size of the feline mandible, the hypothesis of the study reported here was that one-and-one-half mandibulectomy would be effective for local control of oral SCC in cats with subcentimetrical superficial lesions with the condition of the lesion being located in the rostral part, particularly caudal the canine tooth but more research is necessary.

We conclude that most of the complications encountered are manageable, of low extent with the exception of feeding ability in the post-surgery period. We could propose as early indicators of prognosis the feeding behaviour before disease/surgery and the self-grooming abilities after surgery, noting that they may be highly subjective. Early disease detection, awareness, avoidance of predisposing factors and, if necessary, prompt aggressive treatment can lead to the best outcomes in cats with oral SCC.

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