Pinnal squamous cell carcinoma in cats and the effectiveness of treatment with radical pinnectomy

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ABSTRACT: The aim of this study was to observe the effectiveness of treatment with radical pinnectomy and investigate postoperative relapse cases in pinnal squamous cell carcinoma in cats. Twelve cats which were brought to surgery clinic of Istanbul University, Faculty of Veterinary Medicine were used. Biopsies were taken from the cases in which squamous cell carcinoma was suspected following anamnesis and the clinical examination of patients that were brought to our clinic. The patients were diagnosed on the basis of histopathological analysis of biopsy samples. Haemogram and biochemical blood analysis were performed and thoracic radiographs were taken as routine in cases that a decision was made to operate. After the area was prepared for operation radical pinnectomy or total external acoustic canal ablation along with radical pinnectomy were performed in the patients that were eligible for operation. Relapses seen in the postoperative period were re-operated with the techniques selected according to invasion status. Periodic controls of the patients were made after the operations and the cats were examined for relapse. In seven out of 12 cases, only squamous cell carcinoma; in three cases, actinic dermatitis actinic dermatitis in addition to squamous cell carcinoma, and in two cases, only actinic dermatitis lesions were detected. In the postoperative period, relapse was observed in the cases in which the squamous cell carcinoma lesion reached the lower half of the pinna or the external acoustic canal while relapse was not observed in cases with actinic dermatitis lesions or when the squamous cell carcinoma lesion was on the top part of the pinna. Relapse cases were re-operated using different operative techniques. It is concluded that performing radical pinnectomy on actinic dermatitis lesions detected on the pinna before development into squamous cell carcinoma, and removing the tumour according to its localization with radical pinnectomy or total external acoustic canal ablation alongside radical pinnectomy is the most reliable treatment option in terms of relapse in cases of pinnal squamous cell carcinoma.

Keywords: ear; pinna; actinic dermatitis; squamous cell carcinoma; radical pinnectomy; cat

List of abbreviations

AD = actinic dermatitis, **MAC** = minimum alveolar concentration, **PP** = partial pinnectomy, **RP** = radical pinnectomy, **SCC** = squamous cell carcinoma, **TEACA** = total external acoustic canal ablation, **VEACA** = vertical external acoustic canal ablation

Many tumours of the skin also can also be observed on the pinna (Gustafson Beaver and Knauer 1975; Angarano 1988; Kristensen et al. 1996; Harvey et al. 2001; Fossum 2007). The most common skin tumour in cats is squamous cell carcinoma (SCC) (Gustafson Beaver and Knauer 1975; Angarano 1988; Kristensen et al. 1996; Harvey et al. 2001; Fossum 2007; Cunha et al. 2010). Melanoma, fibroma, lymphoma, papilloma (Fossum 2007), basal cell tumours, fibrosarcomas, mast cell tumours (Fossum 2007; Harvey et al. 2001), histyocytomas (Angarano 1988; Fossum 2007) are the other tumours that are observed.

Although it is mostly seen on the pinna (Miller et al. 1991; Harvey et al. 2001; Cunha et al. 2010), SCC is also seen on the nose and eyelids (Madewell

and Theilen 1987; Miller et al. 1991; Kristensen et al. 1996; Lanz and Wood 2004; Marignac 2005; Fossum 2007; Cunha et al. 2010). Pinnal SCC are bilateral in 50% of cases (Kristensen et al. 1996). They have been described in completely or partially white haired cats (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Kristensen et al. 1996; Rosychuk and Luttgen 2000; Harvey et al. 2001; Henderson and Horne 2003; Lanz and Wood 2004; Marignac 2005; Fossum 2007; Cunha et al. 2010), and white haired cats with blue eyes are predisposed to the condition (Harvey et al. 2001; Matousek 2004).

It has been observed that SCC develop in animals which are exposed to actinic radiation for a prolonged period of time (Gustafson Beaver and Knauer 1975; Harvey et al. 2001; Henderson and Horne 2003; Lanz and Wood 2004; Matousek 2004; Marignac 2005; Fossum 2007; Spugnini et al. 2009; Cunha et al. 2010). For this reason, it is seen more frequently in tropical regions (Harvey et al. 2001). It can also be observed in animals that are exposed to extreme cold (Gustafson Beaver and Knauer 1975). The disease begins as actinic dermatitis (AD) lesions (Madewell and Theilen 1987; Harvey et al. 2001) with erythema, crusting and desquamation constituting early signs of AD (Peters-Kennedy et al. 2008). AD develops into SCC by neoplastic transformation in animals which are exposed to extended periods of actinic radiation (Harvey et al. 2001; Matousek 2004; Peters-Kennedy et al. 2008; Spugnini et al. 2009). Clinically, lesions that are characterised by erosion, thickening (Harvey et al. 2001; Fossum 2007), ulceration and crusting, stand out (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Schick 1994; Harvey et al. 2001; Henderson and Horne 2003; Schick and Marignac 2005; Fossum 2007; Peters-Kennedy et al. 2008). The wound tends to bleed with very little trauma. Care should be taken to distinguished SCC lesions from insect bites or immune-mediated diseases (Marignac 2005; Fossum 2007).

Hyperthermia (Madewell and Theilen 1987; Rosychuk and Luttgen 2000; Lanz and Wood 2004;Vail and Withrow 2007; Cunha et al. 2010), intralesional chemotherapy (Lanz and Wood 2004, Vail and Withrow 2007; Spugnini et al. 2009, Cunha et al. 2010), systemic chemotherapy (Madewell and Theilen 1987; Rosychuk and Luttgen 2000; Lanz and Wood 2004; Matousek 2004; Fossum 2007; Vail and Withrow 2007; Peters-Kennedy et al. 2008; Cunha et al. 2010), electrochemotherapy (Spugnini et al. 2009), photodynamic therapy, cryotherapy (Madewell and Theilen 1987; Rosychuk and Luttgen 2000; Lanz and Wood 2004; Matousek 2004; Fossum 2007; Vail and Withrow 2007; Peters-Kennedy et al. 2008; Spugnini et al. 2009; Cunha et al. 2010), brachytherapy (Madewell and Theilen 1987, Vail and Withrow 2007), strontium plesiotherapy (Rosychuk and Luttgen 2000; Vail and Withrow 2007; Peters-Kennedy et al. 2008; Spugnini et al. 2009), radiotherapy (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Lanz and Wood 2004; Matousek 2004; Fossum 2007; Vail and Withrow 2007; Peters-Kennedy et al. 2008; Spugnini et al. 2009; Cunha et al. 2010) and surgical removal (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Rosychuk and Luttgen 2000; Lanz and Wood 2004; Matousek 2004; Fossum 2007; Vail and Withrow 2007; Peters-Kennedy et al. 2008; Spugnini et al. 2009; Cunha et al. 2010) are among the treatment options for SCC. While cryotherapy can be effective for small and superficial tumours (Rosychuk and Luttgen 2000; Harvey et al. 2001; Lanz and Wood 2004; Fossum 2007), relapse is often observed (Rosychuk and Luttgen 2000; Harvey et al. 2001; Fossum 2007). Radiotherapy is a more aesthetic treatment option than surgical removal and may be an alternative method for small, superficial tumours and pre-neoplastic lesions (Fossum 2007). Although there are many intralesional or systemic drugs, this is not an effective treatment option in SCC (Lanz and Wood 2004). It has been reported in a study comparing surgical excision, cryotherapy and radiotherapy that surgical excision is the method which results in the lowest rates of relapse for the longest period of time (Harvey et al. 2001).

SCC is a tumour with a very low probability of distant or regional metastasis (Madewell and Theilen 1987; Kristensen et al. 1996; Harvey et al. 2001; Lanz and Wood 2004; Matousek 2004; Marignac 2005; Fossum 2007; Vail and Withrow 2007 Spugnini et al. 2009; Cunha et al. 2010), but it is likely to have local relapse and invasion (Schick and Schick 1994; Kristensen et al. 1996; Harvey et al. 2001; Lanz and Wood 2004; Matousek 2004; Marignac 2005; Fossum 2007; Vail and Withrow 2007). For this reason, radical excision may be the best solution (Gustafson Beaver and Knauer 1975; Schick and Schick 1994; Harvey et al. 2001; Lanz and Wood 2004; Marignac 2005; Fossum 2007). Tattooing (Harvey et al. 2001), using sun protective creams (Schick and Schick 1994; Rosychuk and

Luttgen 2000) or keeping the affected animal inside between 10:00 and 16:00 (Rosychuk and Luttgen 2000; Marignac 2005), may be useful for protection from sunlight.

MATERIAL AND METHODS

Twelve cats formed the basis of this study. Eleven of these 12 cats were referred with the complaint of a pinnal wound. One cat (case No. 1) was referred with a complaint of lameness and dermatitis was seen on the pinna during the examination. Information about the cats' age, gender, breed, colour, and the side of the lesions are shown in Table 1.

The patients underwent examination after the medical history was taken from the cats' owners and after the owners were informed regarding the appropriate operative method with respect to the width of the lesion. Additionally, mandibular, retropharyngeal, prescapular and popliteal lymph node examinations were undertaken by palpation. Exams were performed with thorax x-ray in terms of close and distant metastases. Estradiol in blood was examined in nine female cases.

Because of bad general condition after the exam, regulatory treatment of the overall status was withheld for case No. 6 until the operation and histopathological examination was performed by taking a small piece from the ulcerated region with the help of a scalpel. However, the patient died during the preoperative period and the operation could not be performed.

The owners of cases No. 4, No. 7, and No. 9 did not accept surgery for aesthetic concerns. For that reason these cases could not be operated. In these patients, diagnosis was made with incisional biopsy after sedation with 80 µg/kg dose medetomidin hidroklorid (Domitor®, Pfizer, Germany).

Although case No. 1 had been referred with a complaint of lameness, lesions were seen on the apex pinna during the systemic examination. With consideration to the appearance of the patient, these lesions were diagnosed as AD lesions which are the precancerous phase of SCC.

Complete blood count and biochemical blood analysis was performed and after determining that they were eligible for operation, the cats were catheterised with 22 G angiocatheter (Vasofix®Braunüle®, Braun, Germany). Patients were intubated with AD: 2.50 mm intratracheal tube (Kruuse, Denmark) after the induction which had been made with a 8 mg/kg dose of propofol (Propofol 1% Fresenius®, Fresenius Kabi, Germany). Then, anaesthesia was established with isoflurane (Forane®, Abbott, England). The starting dose was 3.5% minimum alveolar concentration (MAC) and the maintenance dose was 1.5% MAC. The areas of operation were made limited by sterile surgical linens after shaving, and disinfection.

Cases No. 1, No. 2, No. 8, and No. 11 received bilateral radical pinnectomy (RP), while case No. 3 and No. 10 received unilateral RP. The pinna was removed 3 mm over the forceps after it was fixed as far as possible to the closest part to the head with haemostatic forceps. Surgical wounds were sutured

Table 1. Age, gender, breed, colour, and the localisation of the lesions for each case

Case No.	Age	Gender	Breed	Iris colour	Hair colour	Side of the lesion
1	6	F	Ankara	right blue, left yellow	white	bilateral
2	13	M	Ankara	right blue, left yellow	white	bilateral
3	5	F	Van	right blue, left yellow	white	unilateral
4	11	F	Ankara	yellow	white	bilateral
5	11	M	Ankara	yellow	white	unilateral
6	8	M	mixed	yellow	white-mealy	unilateral
7	11	F	mixed	yellow	white-yellow	unilateral
8	13	F	Ankara	yellow	white	bilateral
9	12	F	mixed	yellow	white-mealy	bilateral
10	10	F	mixed	yellow	white-mealy	unilateral
11	5	F	Ankara	blue	white	bilateral
12	8	F	mixed	yellow	white-yellow-black	bilateral

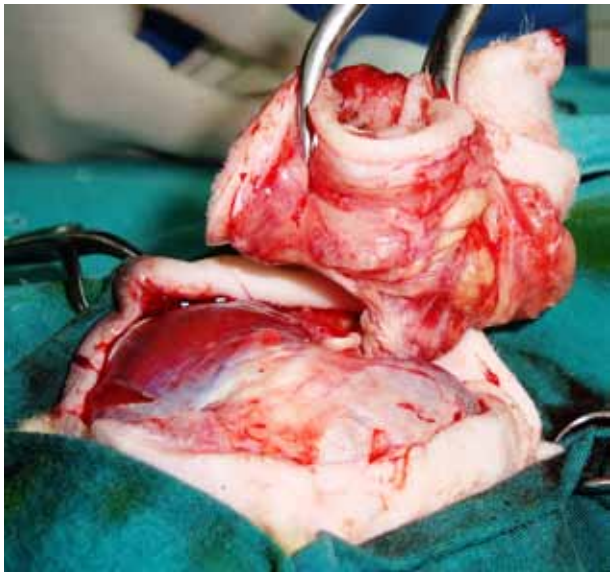

Figure 1. Removing the mass from the pinna with TEACA and RP

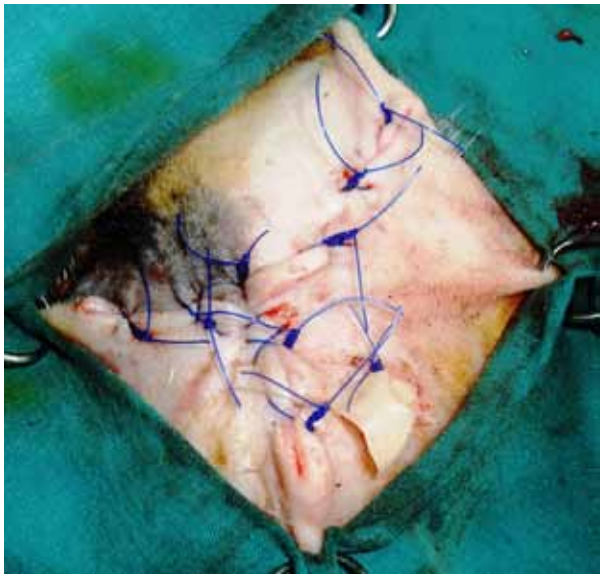

Figure 2. Closing the surgical wound with polypropylene by placing drain

as simple continuous sutures with 3/0 synthetic polypropylene (Prolene®, Ethicon, USA).

Cases No. 5 and No. 12 received total external acoustic canal ablation (TEACA) along with RP due to invasion of the external ear canal by the lesion. For this purpose, an eliptic incision was made surrounding the pinna. Following this incision, dissection was performed in the pinna and deep-tissue including the meatus acusticus externus. The mass was removed from the connecting point of the horizontal external ear canal and bulla tympanica (Figure 1). By placing a penrose drain pouches sutured with 3/0 synthetic polypropylene (Prolene®, Ethicon, USA) emerged as simple separate sutures (Figure 2).

Protection collars were fitted onto all patients in order to prevent possible harm to the surgical area by scratching or rubbing in the postoperative period. There was no need for any bandage implementation. All patients received a 8.75 mg/kg dose of amoxicillin – clavulanic acid (Synulox®, Pfizer, Germany) half an hour before operation and the same antibiotic was continued for seven days postoperatively. Wounds were checked and sutures were taken out on the 12th day.

Samples taken for histopathological examination were fixed in 10% buffered formalin solution and routine tissue processing was performed. The samples were embedded in paraffin blocks. Then, 3–5 mμ thick sections were taken with a microtome and stained with haematoxylin and eosin. These were examined using a light microscope at 100×, 200×, and 400× magnification and diagnosed with AD/SCC based on histopathological features.

RESULTS

The presence of bilateral or unilateral lesions on the pinna was the complaint of owners in all cases except case No. 1. The owners related that initially small wounds emerged in the pinna and that these wounds did not heal with standard wound treatments. These wounds then grew and spread over the whole pinna. The owner of case No. 11 stated that her cat wanted to go outside and after it had been living outside for a month, erythema appeared on the back of the pinna (Figure 3). The owners of cases No. 4, No. 6 and No. 7 stated that these cases had received partial pinnectomy previously but that subsequently relapse had occurred (Figure 4).

Bilateral lesions were detected by inspection in seven cases out of 12. The lesion was at the AD

Figure 3. Case No. 11 with bilateral pinnal erythema

Figure 4. Case No. 4 previously received partial pinnectomy and relapse occurred

stage on one ear while there was ulceration at different levels (Figure 5) on the other ear in three bilateral cases (Case No. 2, No. 4, and No. 8). Bilateral pinnal ulcerations were observed in cases No. 9 and No. 12 (Figure 6). The lesion was at the bilateral AD stage in cases No. 1 and No. 11 (Figure 7).

It was observed that unilateral pinnal lesions were extensive and ulcerative in cases No. 3, No. 5, No. 6, No. 7, and No. 10.

Estradiol levels were determined to be higher than the normal reference values (10–50 pg/dl) in nine female cases. The estradiol levels in these animals are shown in Table 2.

Relapse was not observed 16 months later at check-up of case No.1, 26 months later at the check-up of case No. 8 (Figure 8 and 9) and 14 months later at the check-up of case No. 11, all of which received bilateral RP.

Figure 6. Case No. 12 with pinnal SCC characterised by bilateral ulceration

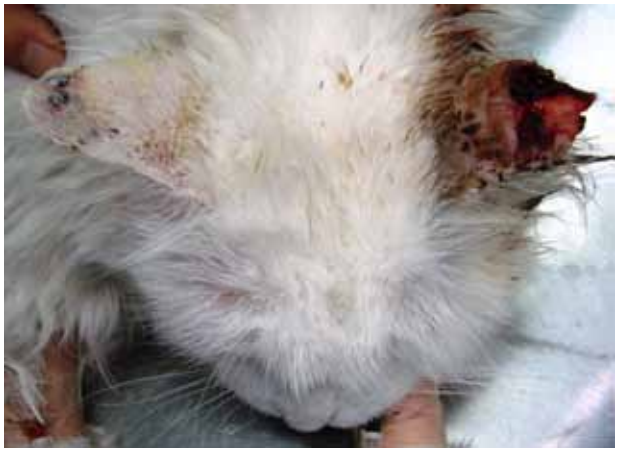

Figure 5. Case No. 8 with an AD lesion on the right pinna and SCC lesion on the left pinna

Relapse was not observed until the 6th month in case No. 2. In the 7th month relapse was observed on the right surgical area. The patient's owner did not accept the proposal of re-operation and when the patient came back 15 months later, the tumour had spread to a wide area (Figure 10). RP was performed along with TEACA and the wide operation wound was closed with an omocervical axial skin

Table 2. Estradiol levels of female cases

Case No.	Estradiol level (pg/dl)
1	64
3	114
4	86
7	78
8	106
9	97
10	92
11	55
12	73

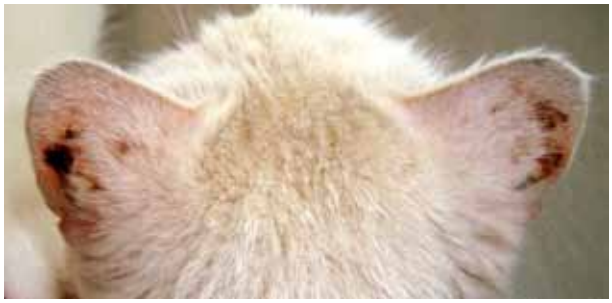

Figure 7. Case No. 1 with a bilateral AD lesion

Figure 8. Case No. 8 that received bilateral RP; picture was taken postoperatively, 26 months later (right pinna)

Figure 9. Case No. 8 that received bilateral RP; picture was taken postoperatively, 26 months later (left pinna)

flap (Figure 11). Relapse was observed again after three months and extirpation of the tumour was carried out. Relapse was not observed for seven months after this operation. No relapse was observed on the left side in this patient over the entire 25-month period. However, at approximately 16 years of age the patient died due to systemic disease.

No relapse was observed in the postoperative 13 month follow-up period in case No. 10, or at 28 months in case No. 3, both of whom received RP.

Relapse was seen four months later on the left, and six months later on the right side in case No. 12 which received RP along with TEACA fifteen days apart on both its right and left sides. No relapse

Table 3. Lesion types, treatment methods and post-operative process and results for each case

Case No.	Lesion type	Treatment	Postoperative control time (month)	Result
1	bilateral AD	bilateral RP	16	no relapse
			25	no left-relapse
		bilateral RP	7	right-relapse
2	right SHK, left AD		15	right-relapse expanded
		right TEACA	3	relapse
		tumor extirpation	7	no relapse
3	unilateral SCC	RP	28	no relapse
4	right SCC, left AD	could not be done		
5	unilateral SCC	RP + TEACA	2	relapse euthanasia
6	unilateral SCC	could not be done		
7	unilateral SCC	could not be done		
8	left SCC, right AD	bilateral RP	26	no relapse
9	bilateral SCC	could not be done		
10	unilateral SCC	RP	13	no relapse
11	bilateral AD	bilateral RP	14	no relapse
12	bilateral SCC	bilateral RP + TEACA	4	left relapse
			6	right relapse
		bilateral tumor extirpation	15	no relapse

Figure 10. Evenly spread pinnal SCC in case No. 2

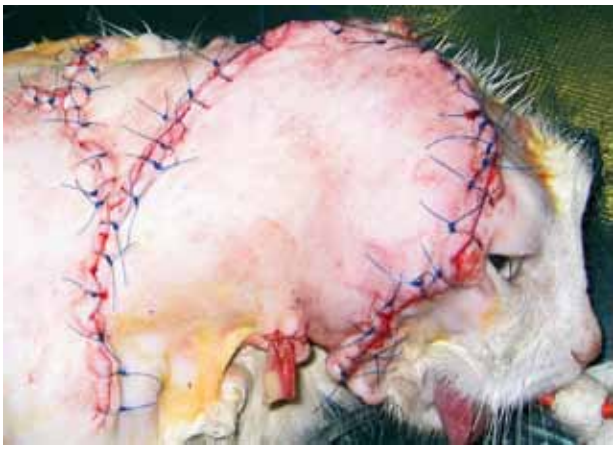

Figure 11. Case No. 2 after operation

was observed in the 15-month period following tumour extirpation.

The wide operation wound was closed with an omocervical axial skin flap in case No. 5. Three months later it was seen that the wound was not closed entirely, the tumour had relapsed, and had deeply invaded further tissues. The decision was made to perform euthanasia.

The information about the types of lesion in each case, treatment methods and post-operative processes and outcomes are shown in Table 3.

Dysplastic changes in the epidermal cells, parakeratotic hyperkeratosis on the superficial epidermal layer, and inflammation which was composed of mononuclear cells were observed during histopathologic examination of the patients that were diagnosed with AD. Apparent hyperkeratosis on the surface of the epidermis, ulceration, and malignant squamous differentiation in epidermal cells were observed at histopathologic examination of the patients that were diagnosed with SCC. It was observed that while these atypical epithelial cells, which had a vesicular core and a small amount of cytoplasm, were creating papillary protrusions on the surface of the epidermis, they also organised in the form of small islets and invaded the subcutaneous tissue. The neoplastic cells were marked by atypical mitotic figures and malignant features

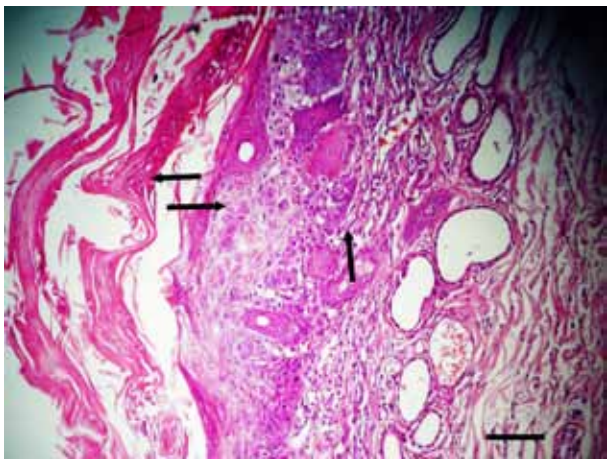

Figure 12. Histopathological appearance of the right pinna in case No. 8 that was diagnosed with AD. Arrow pointing to the left shows hyperkeratosis, arrow pointing to the right shows dysplasia, the arrow pointing upwards shows inflammatory cells which were composed of neutrophils, mast and macrophages. Bar: 100 μ

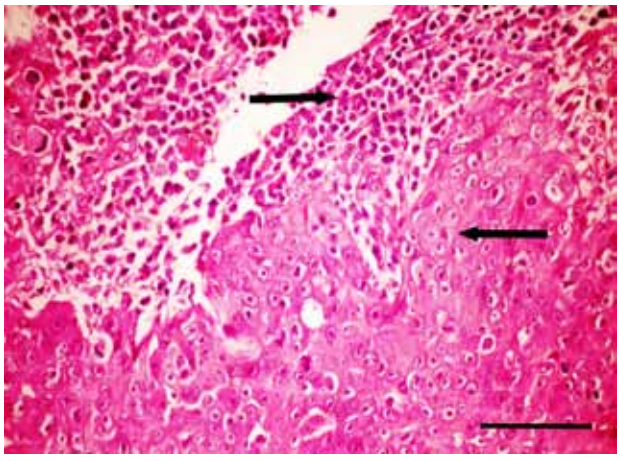

Figure 13. Histopathological appearance of the left pinna of case No. 8 that was diagnosed with SCC. Arrow pointing to the right shows mononuclear and polymorph inflammatory cells in the tumour tissue, arrow pointing to the left shows the area of SCC. Bar: 1 μm, 200× inspection

such as apparent anisocytosis, anisocariosis and multinucleation. Degenerative changes, epithelial hyperplasia in hair follicles and inflammatory infiltration foci which were mainly composed of mast cells were determined in the lower layer, at collagen bundles in the dermis. It was observed that the inflammatory infiltration, which was composed of mononuclear cells, spread from the epidermis to the subcutaneous tissue in some areas (Figure 12 and 13).

DISCUSSION

All pinnal neoplasms, which were observed in the cats brought to our clinic between 2002 to 2011 were diagnosed with SCC. This finding mirrors reports available in the literature (Gustafson Beaver and Knauer 1975; Angarano 1988; Kristensen et al. 1996; Harvey et al. 2001; Fossum 2007; Cunha et al. 2010) which indicates that SCC is the most common neoplasm of in the pinna of cats.

Lesions were bilateral in seven out of 12 cases (58.3%) and this again is in agreement with the literature (Kristensen et al. 1996) which indicates that this disease is observed bilaterally at a rate of 50%.

Seven out of the 12 cases studied here had white and the other five cases had white-mealy or white-yellow hair colour. This supports the literature (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Kristensen et al. 1996; Rosychuk and Luttgen 2000; Harvey et al. 2001; Henderson and Horne 2003; Lanz and Wood 2004; Marignac 2005; Fossum 2007; Cunha et al. 2010) in which lesions in white or partially white haired cats have been reported. Additionally with regard to hair colour, as seven out of 12 cases in our study were white-haired Van and Ankara breeds which are specific to Turkey, this study revealed that these breeds show predisposition to this disease.

In eight out of 12 cases in our study the iris was yellow in both eyes, three cases had yellow iris colour in one eye and blue in the other, and only one case had bilateral blue iris colour. All 12 cases had white hair colour and 11 eyes from these cases had yellow iris colour while in four eyes the iris was blue in colour. This does not match the literature (Harvey et al. 2001; Matousek 2004) as it has been reported that white-haired cats with blue iris colour show predisposition to this disease. These findings suggest that cats with yellow iris colour might be predisposed to pinnal neoplasms.

Nine out of 12 cases (75%) in this study were female, and this is consistent with the findings of Cunha et al. (2010) which indicate that lesions are often seen in female animals. The occurrence of dermatoses in dogs due to hyperestrogenism has been described (Scott et al. 2001). In all nine cases in this study, estradiol levels were higher than the normal reference values which are indicated in the literature (Feldman and Nelson 2004). This suggests that hyperestrogenism might play a role in the pathology of AD and SCC in cats.

In the study of Madewell and Theilen (1987) it is indicated that SCC lesions emerge in cats older than five years of age. All 12 cases in our study were older than five years of age which is in agreement with this previous finding. Despite studies that indicate SCC is seen in cats of the average age of 11 (Cunha et al. 2010) or 12 years old (Rosychuk and Luttgen 2000; Harvey et al. 2001; Vail and Withrow 2007), the mean age was approximately 9.5 in our study. In fact, case No. 3 was five years and case No. 6 was eight years old. These cases had extensive, ulcerative lesions demonstrating that the disease can occur also in young animals. In addition, because earlier reports have indicated a mean age only for SCC, the mean age was smaller than that reported previously in our study. In case No. 11 (five years old), and in case No. 1 (six years old), lesions were determined at the bilateral AD phase. The determined mean age for SCC is high due to a high probability of missing the disease and low probability of visiting a veterinarian at the AD stage. Because AD is the early stage of SCC, we believe that if AD were detected, the mean age which has been reported in the literature might fall dramatically.

In two cases (case No. 1 and No. 11) bilateral AD lesions, and in three cases (case No. 2, No. 4, and No. 8) unilateral AD lesions were determined, and there were SCC lesions in the contralateral of cases which had unilateral AD. These findings coincide with the studies (Madewell and Theilen 1987; Harvey et al. 2001) which report that SCC starts as AD on the apex pinna of cats. However, although Peters-Kennedy and colleagues (2008) identified erythema, crusting and scaling as early cutaneous signs of AD, in our study, we observed that these symptoms appeared after the lesion convert to SCC. The only early symptoms of AD were keratosis and pigmentation on the skin.

The cats studied here, except for case No. 1, were brought to our clinic with complaints of erythe-

ma, crusting and wounds on the pinna that did not heal. Clinical signs of the disease coincide with the symptoms which are reported in the literature (Gustafson Beaver and Knauer 1975; Madewell and Theilen 1987; Schick and Schick 1994; Harvey et al. 2001; Henderson and Horne 2003; Marignac 2005; Fossum 2007; Peters-Kennedy et al. 2008).

Although Harvey et al. (2001) state that partial pinnectomy (PP) can be performed once actinic damage is seen, we believe PP may be performed when AD damage is very small and on the top half of the pinna. However, RP is the more reliable method. Fossum (2007) reported that surgical removal of SCC lesions could be performed only with pinnectomy or vertical external acoustic canal ablation (VEACA) along with pinnectomy. Based on our findings, we believe RP application could be sufficient when AD or SCC is located on the top half of the upper pinna. VEACA may be tried for SCC cases which have invaded the lower half of the pinna but have not spread to the external ear. However, as the vertical external acoustic canal is very small in cats, it is possible that the entire tumour is not removed. Thus, it might be a technique that is open to risk of relapse. We believe that TEACA should be performed along with RP in SCC cases which have spread over the whole lower half of the pinna or external acoustic canal. Although in two cases (case No. 2 and No. 5), we performed TEACA which is the most aggressive surgical method when the tumour has invaded external acoustic canal, we observed relapse. This supports the findings of researchers (Schick and Schick 1994; Kristensen et al. 1996; Harvey et al. 2001; Lanz and Wood 2004; Matousek 2004; Marignac 2005; Fossum 2007; Vail and Withrow 2007) who have reported that SCC has high local invasion ability.

The histopathological findings that we report are in agreement with the histopathological findings which are indicated in the literature (Goldschmidt et al. 1998; Scott et al. 2001).

Local or distant metastases were not seen in any of our cases and this mirrors the literature data (Madewell and Theilen 1987; Kristensen et al. 1996; Harvey et al. 2001; Lanz and Wood 2004; Matousek 2004; Marignac 2005; Fossum 2007; Vail and Withrow 2007; Spugnini 2009; Cunha et al. 2010).

The owners of cats with lesions do not notice these lesions that emerge on the pinna before they develop into SCC, and even if they have noticed, they evaluate the lesion as a simple wound and do not go to a veterinarian. For this reason, animal owners, especially the ones who keep their cast outside, should be informed in detail about the predisposition of their cats to pinnal squamous cell carcinoma.

Early diagnosis of this disease is very difficult and very important in terms of prognosis. Interventions that are made in the early period can have a serious influence on the patient's life expectancy. It is well recognised that SCC is a tumour with an invasive character and that there are not many treatment options when it invades tissues deeply in the auricular area.

Consequently, this study shows that with regard to the predisposition of cats, before the detected AD develops into SCC, performing RP, or if the transformation to SCC has already happened, performing RP or TEACA along with RP according to localisation on the pinna, are the most reliable treatment options in terms of recurrence.

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REFERENCES

Angarano DW (1988): Diseases of the pinna. Veterinary Clinics of North America: Small Animal Practice 18, 869–884.

Cunha SCS, Carvalho LAV, Canary PC, Reisner M, Corgozinho KB, Souza HJM, Ferreira AMR (2010): Radiation therapy for feline cutaneus squamous cell carcinoma using a hypofractionated protocol. Journal of Feline Medicine and Surgery 12, 306–313.

Feldman EC, Nelson RW (2004): Feline reproduction. In: Feldman EC, Nelson RW (eds.): Canine and Feline Endocrinology and Reproduction. 3rd ed. Saunders, Missouri. 1016–1044.

Fossum TW (2007): Surgery of the ear. In: Fossum TW (ed.): Small Animal Surgery. 3rd ed. Mosby, Missouri. 289–316.

Goldschmidt MH, Dunstan RW, Stannard AA, von Tscharner C, Walder EJ, Yager JA (1998): Histological Classification of Epithelial and Melanocytic Tumors of the Skin of Domestic Animals. WHO International Histological Classification of Tumors of Domestic Animals. 2nd Series. Vol. 3. Armed Forces Institute of Pathology, American Registry of Pathology, Washington, DC. 18–41.

Gustafson Beaver BV, Knauer KW (1975): The ear. In: Catcott EJ (ed): Feline Medicine and Surgery. 2nd ed. American Veterinary Publications, California. 519–526.

Harvey RG, Harari J, Delauche AJ (2001): Ear Diseases of the Dog and Cat. Manson Publishing, London. 272 pp.

Henderson RA, Horne R (2003): Pinna. In: Slatter D (ed.): Textbook of Small Animal Surgery. 3rd ed. Saunders, Philadelphia. 1737–1746.

Kristensen F, Jacobsen JO, Eriksen T (1996): Otology in Dogs and Cats. Leo, Denmark. 78 pp.

Lanz OI, Wood BC (2004): Surgery of the ear and pinna. Veterinary Clinics of North America: Small Animal Practice 34, 567–599.

Madewell BR, Theilen GH (1987): Tumors and tumor-like conditions of epithelial origin. In: Theilen GH, Madewell BR (eds.): Veterinary Cancer Medicine. 2nd ed. Lea and Febiger, Philadelphia. 240–266.

Marignac G (2005): Diseases that affect the pinna. In: Gotthelf LN (ed.): Small Animal Ear Diseases: An Illustrated Guide. 2nd ed. Elsevier Saunders, Missouri. 235–263.

Matousek JL (2004): Diseases of the ear pinna. Veterinary Clinics of North America: Small Animal Practice 34, 511–540.

Miller MA, Nelson SL, Turk JR, Pace LW, Brown TP, Shaw DP, Fischer JR, Gosser HS (1991): Cutaneous neoplasia in 340 cats. Veterinary Pathology 28, 389–395.

Peters-Kennedy J, Scott DW, Miller WH (2008): Apparent clinical resolution of pinnal actinic keratoses and squamous cell carcinoma in a cat using topical imiquimod 5% cream. Journal of Feline Medicine and Surgery 10, 593–599.

Rosychuk RAW, Luttgen P (2000): Diseases of the ear. In: Ettinger SJ, Feldman EC (eds.): Textbook of Veterinary Internal Medicine: Diseases of the Dog and Cat. Vol. 2. 5th ed. W.B. Saunders Company, Pennsylvania. 986–1002.

Schick MP, Schick RO (1994): Pinnal diseases. In: Birchard SJ, Sherding RG (eds.): Saunders Manual of Small Animal Practice. W.B. Saunders Company, Pennsylvania. 369–374.

Scott DW, Miller WH, Griffin CE (2001): Neoplastic and non-neoplastic tumors. In: Muller and Kirk's Small Animal Dermatology. 6th ed. Saunders, Philadelphia. 1236–1414.

Spugnini EP, Vincenzi B, Citro G, Tonini G, Dotsinsky I, Mudrov N, Baldi A (2009): Electrochemotherapy for the treatment of squamous cell carcinoma in cats: A preliminary report. Veterinary Journal 179, 117–120.

Vail DM, Withrow SJ (2007): Tumors of the skin and subcutaneous tissues. In: Withrow SJ, Vail DM (eds.): Withrow and MacEwen's Small Animal Clinical Oncology. 4th ed. Saunders Elsevier, Missouri. 375–401.

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