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1 **Title:** Parotidectomy for the treatment of parotid sialocele in 14 dogs

2

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12 **SUMMARY**

13

14 ***Objectives***

15 To describe the presentation, diagnosis, cause, complications and outcome in 14 dogs that
16 presented with a parotid sialocele and that were treated with complete parotidectomy.

17

18 ***Material and Methods***

19 Multi-institutional retrospective study.

20 ***Results:***

21 All patients presented with a non-painful, fluctuant, soft tissue mass over the lateral aspect of
22 the face in the region of the parotid salivary gland. A diagnosis was made by means of
23 sialoradiography(3/14), CT(3/14), ultrasound(11/14) and MRI(2/14). The cause of the
24 sialocele could be determined in 8 out of 14 patients and included: foreign body(2/14),
25 sialolithiasis(1/14), neoplasia(3/14), salivary gland lipomatosis(1/14) and trauma(1/14). One
26 anaesthetic complication (regurgitation) and 7 postoperative surgical complications were
27 recorded (self-limiting seroma formation(2/14), haemorrhage(1/14), wound
28 dehiscence(1/14), abscessation 7 months postoperatively due to a retained part of a penrose
29 drain(1/14) and facial nerve paralysis(2/14). None of the patients had recurrence of the
30 sialocele with a median follow-up time of 14 months.

31

32 ***Clinical significance:***

33 Parotidectomy has historically been considered a technically challenging procedure but we
34 report that in the hands of an experienced surgeon it can have a good success rate with long-
35 term resolution of the clinical symptoms. Despite this, intra- and postoperative complications
36 can occur and owners should be warned of this prior to surgery.

37 **INTRODUCTION**

38 A sialocele is a collection of saliva within the subcutaneous tissue caused by leakage from the
39 salivary gland or more commonly its associated duct. These saliva-filled cavities are lined by
40 inflammatory tissue rather than epithelial cells and therefore are not true cysts (Torad and
41 Hassan 2013). The majority of sialoceles are idiopathic and other causes such as trauma,
42 sialoliths, foreign bodies and neoplasia have been described (Waldron and Smith 1991). One
43 patient developed a cervical sialocele as a result of dirofilariosis (Henry 1992).

44 The location of the sialocele typically determines the presenting complaint and gives a good
45 indication of the offending salivary gland with the submandibular and sublingual glands being
46 most frequently affected followed by the zygomatic salivary gland (Dunning 1985). Reports of
47 parotid sialoceles are uncommon (Goldsworthy and others 2013, Guthrie and Hardie 2014,
48 Harvey 1977, 1981, Jeffreys and others 1996, Ladlow and Gregory 2003, Termote 2003,
49 Trumpatori and others 2007).

50 Surgery is the treatment of choice for sialoceles as treatment with drainage alone typically
51 results in recurrence in 40% of affected animals. (Waldron and Smith 1991). Several surgical
52 treatments have been proposed for parotid sialoceles including parotidectomy (Guthrie and
53 Hardie 2014, Trumpatori and others 2007), ligation of the duct proximal to the defect
54 (Goldsworthy and others 2013, Harvey 1977), anatomical reconstruction of the duct defect
55 (Harvey 1977, Jeffreys and others 1996, Termote 2003) and marsupialisation (Ladlow and
56 Gregory 2003).

57 According to Ritter and Stanley (2012), parotidectomy is a technically challenging procedure
58 because of the intimate association of the parotid capsule with its surrounding structures.
59 Dunning (1985) reports a high risk of postoperative complications including iatrogenic facial
60 nerve damage but there is currently little information on postoperative complications in the
61 literature. To the authors' knowledge, only two individual case reports of parotid sialoceles

62 treated with parotidectomy have been published and only one reports on postoperative facial
63 nerve function (Guthrie and Hardie 2014, Trumpatori and others 2007). Therefore, information
64 on the risk of parotidectomy in the veterinary literature is currently lacking.

65 The purpose of this study was to describe the presentation, diagnosis, cause, complications and
66 outcome in 14 patients that presented with a parotid sialocele and that were treated with
67 complete parotidectomy.

68

69 **MATERIAL AND METHODS**

70 Medical records of 6 referral practices were retrospectively reviewed for the condition of
71 parotid sialocele over the period from 2007 to 2014. Patients were included if the condition was
72 treated using a parotidectomy as described by Ritter and Stanley (2012) with a minimum of 6
73 months follow-up. All procedures were performed or supervised by a Diplomate of the
74 European College of Veterinary Surgeons. The following data were obtained: patient
75 identification, breed, age, weight, sex, presenting clinical symptoms, duration of symptoms prior
76 to diagnosis, diagnostic imaging, aetiology, results of cytology if performed pre-operatively,
77 culture and sensitivity results, intra- and postoperative complications, histopathology of
78 resected gland, recurrence and outcome. Descriptive statistical analysis was performed using a
79 statistical software package (Excel for Mac, Microsoft Corporation). Major complications were
80 defined as those requiring further treatment (surgical or non-surgical) whereas minor
81 complications were self-limiting and did not require further treatment. Patients were classed
82 as having postoperative facial nerve paralysis if there was no facial nerve function present 6
83 months postoperatively.

84

85 **RESULTS**

86 *Signalment*

87 Fourteen cases met the inclusion criteria (Table 1). The mean age of all patients was 7.8 years
88 (SD 3.5 years). There were 7 female and 7 male dogs. Neutering status was known for all dogs
89 and 11 out of 14 patients were neutered. There were 3 boxers, 1 terrier cross, 1 Rottweiler, 1
90 basset hound, 2 crossbreeds, 1 bearded collie, 1 British bulldog, 1 Jack Russell terrier, 1 saluki
91 and 2 springer spaniels.

92

93 *Clinical symptoms*

94 The duration of the clinical signs before referral ranged from 7 to 760 days with a mean of 117
95 and a median of 30 days. All patients presented with a non-painful, fluctuant, soft tissue mass
96 over the lateral aspect of the face across from the masseter muscle to the parotid region. Other
97 clinical signs were: pain on opening of the mouth and inability to open the mouth fully (n=1),
98 presence of a firm mass in the parotid region associated with the sialoceles (n=3) and intra-oral
99 swelling and sinus at the level of the 4th pre-molar (n=1). All patients had normal facial nerve
100 function on presentation.

101

102 *Diagnostic Imaging*

103 The most commonly used diagnostic modality in this case series was ultrasound (11/14
104 patients) followed by sialography (3/14), computed tomography (CT) (3/14) and magnetic
105 resonance imaging (MRI) (2/14). Three patients had standard 3-view thoracic radiographs to
106 rule out pulmonary metastasis and in one patient sialoradiography was attempted
107 unsuccessfully prior to CT (Table 1). On ultrasound, all sialoceles appeared as round to tubular
108 echogenic structures with various amounts of central anechoic content and a hyperechoic wall.
109 A foreign body was identified in one patient as an echogenic area with posterior acoustic
110 shadowing and in another patient a suspected adenocarcinoma of the parotid gland manifested
111 itself as a calcified structure at the base of the ear canal. CT was performed in 2 patients and this

112 revealed a fluid filled cavity associated with the parotid salivary gland. In one patient small,
113 mineralised bodies could be seen in the dependent part of the cavity compatible with sialoliths
114 (Fig 1). MRI was used in 2 patients which identified a well-defined collection of fluid ventral to
115 the ear in the region of the parotid gland. This fluid extended rostrally in both patients along the
116 cheek following the path of the parotid duct (Fig 2). On T1-weighted images post contrast
117 injection there was enhancement of the wall of the parotid lesion compatible with a sialocele
118 (Fig 3) and in one patient an enhancing mass of the parotid gland was present.

119

120 *Aetiology*

121 The cause of the sialocele could be determined in 8 out of 14 patients (Table 1) and was: foreign
122 body (2/14), sialolithiasis (1/14), neoplasia (3/14), salivary gland lipomatosis (1/14) and
123 trauma (1/14). The trauma patient had been attacked 7 days prior to referral by a badger and
124 presented with a soft tissue swelling over the lateral aspect of the face and multiple puncture
125 wounds.

126

127 *Cytology*

128 Twelve patients had a fine needle aspiration (FNA) of the mass performed prior to surgery. In
129 all patients, the aspirated fluid was consistent with saliva confirmed by a positive reaction with
130 a mucus-specific stain and in 2 cases there was evidence of a suppurative inflammation with
131 rods and cocci on cytological examination. Culture and sensitivity testing was performed in the
132 patient that was attacked by a badger and this revealed profuse growth of *Klebsiella Oxytoca*.
133 FNA of the three patients with parotid gland adenocarcinomas failed to identify neoplastic cells
134 in one patient. Instead, adipose tissue with secondary neutrophilic inflammation was found.

135

136 *Surgery and Complications*

137 All patients underwent parotidectomy and sialocele drainage using a standard technique as
138 described by Ritter and Stanley (2012) (Fig 4). One anaesthetic and 7 postoperative surgical
139 complications were recorded in 5 patients (Table 1). All patients survived at least 6 months after
140 surgery.

141 The intra-operative, anaesthesia complication consisted of a dog that regurgitated during the
142 anaesthesia and developed aspiration pneumonia, which was diagnosed by clinical examination
143 and radiography. This was treated with a combination of potentiated amoxicillin (Synulox;
144 Pfizer) and metronidazole (Metronidazole; Crescent Pharma Ltd.); the patient improved after
145 several days of hospitalisation and made a full recovery.

146 There were 7 postoperative complications in 5 patients of which 2 were classed as minor and 5
147 as major complications. The 2 minor complications were self-limiting seromas. The major
148 complications consisted of postoperative haemorrhage necessitating revision surgery but not
149 requiring a blood transfusion (1/14), wound dehiscence (1/14) and abscessation 7 months
150 postoperatively (1/14). Two patients (14%) had postoperative, permanent facial nerve
151 paralysis and none of the patients had recurrence of the clinical symptoms with a mean follow-
152 up of 14 months.

153

154

155

156

157 *Histology*

158 Histology of the resected parotid gland was performed in 13 out of 14 patients. Eight of the 13
159 submitted parotid glands had varying degrees of inflammatory changes and 3 had undergone
160 neoplastic transformation in the form of adenocarcinomas; there was one salivary gland
161 lipomatosis and one cystic hyperplasia with fibroplasia and histiocytic inflammation.

162

163 **DISCUSSION**

164 The diagnosis of a sialocele is based on the location and fine needle aspiration of the mass, which
165 typically reveals viscous, golden brown or blood-tinged fluid. Aspirated fluid has a low cell count
166 and reacts positively with a mucus-specific stain such as the periodic acid-Schiff, confirming the
167 diagnosis (Smith 2000). A thorough physical examination usually further denotes the origin of
168 the sialocele and all patients in this case series had a typical swelling on the lateral aspect of the
169 face. In all of our cases, further imaging was performed to investigate the cause of the sialocele.
170 Historically, sialography has been the diagnostic modality of choice to determine the extent and
171 cause of the disease process but this requires general anaesthesia and it can be difficult to locate
172 the duct opening (Smith 2000). If sialography is unsuccessful due to obstruction of the duct or
173 difficulty in cannulating the papilla, advanced imaging can be considered. Ultrasonography and
174 CT have been used as diagnostic modalities and both have been found to be useful in identifying
175 the offending salivary gland and cause of the sialocele (Kneissl and others 2011, Torad and
176 Hassan 2013, Trumpatori and others 2007). In this case series, ultrasound was used more
177 frequently than CT and it was found to be useful in identifying 2 foreign bodies and one
178 suspected neoplasm of the parotid gland. Computed tomography was able to identify a sialolith
179 in one case but no cause could be identified in the 2 other patients. In humans, imaging
180 modalities frequently used to diagnose sialolithiasis include sialography, sialoendoscopy,
181 ultrasonography and more recently CT and MRI (Avrahami and others 1996, Jager and others
182 2000). Sialoendoscopy has become a commonly performed procedure in people but it is not
183 clear if it can be performed in dogs (Nahlieli and Baruchin 1999, Trumpatori and others 2007).
184 To the author's knowledge, this is the first time that MRI has been used in the diagnosis of a
185 parotid sialocele. MRI was useful to identify underlying inflammation of the parotid gland and
186 the extent of the disease process.

187 Surgery is the treatment of choice for sialoceles and in most cases excision of the offending gland
188 is curative and carries a good prognosis with a low risk of postoperative complications (Waldron
189 and Smith 1991). In the case of a parotid sialocele, the surgical removal of the parotid gland is
190 more challenging because of the intimate association of the parotid capsule with its surrounding
191 structures (Ritter and Stanley 2012). Therefore other surgical treatments have been used to
192 address the problem. Anatomical reconstruction of the defect and duct has been described but
193 this relies on the ability to identify and suture the defect (Harvey 1977, Jeffreys and others 1996,
194 Termote 2003). There are also concerns that that duct would not remain patent after
195 reconstruction (Trumpatori and others 2007). Alternatively, the duct can be ligated proximal to
196 the defect as described by Goldsworthy and others (2013) causing atrophy of the gland. Ligation
197 of the proximal parotid duct results in progressive glandular atrophy (Harrison and Garrett
198 1976). This technique produces consistent atrophy of the parotid gland in comparison to the
199 mandibular and sublingual glands which may be related to the predominance of serous cells in
200 the acini of the parotid gland (DeYoung and others 1978). Intra-oral marsupialisation of the
201 distended duct is a simple technique but can only be performed in patients where the sialocele
202 extends to the buccal mucosa. None of the techniques described above would be suitable to deal
203 with a parotid sialocele secondary to a neoplastic process.

204 Dunning (1985) describes parotidectomy for the treatment of parotid sialoceles as a challenging
205 procedure carrying a high risk of complications and permanent facial nerve paralysis but there
206 is currently little evidence in the literature to support this opinion. We report a moderate
207 complication rate in our series with 5 out of 14 patients (35%) developing a major complication
208 requiring further treatment. The first patient with a major postoperative complication
209 developed an acute swelling over the incision site 24 hours after surgery. Fine needle aspiration
210 was suggestive of haemorrhage and because the swelling was getting progressively worse and
211 the patient started to bleed from the incision, the decision was made to revise the procedure.

212 During surgery, active bleeding from a branch of the caudal auricular artery was identified. The
213 vessel was ligated and the patient recovered uneventfully without the need for a blood
214 transfusion. The second postoperative complication consisted of wound breakdown requiring
215 surgical debridement and a muscle flap to reconstruct the lip. This patient had been attacked 7
216 days prior to referral by a badger and presented with a soft tissue swelling over the lateral aspect
217 of the face and multiple puncture wounds. Swabs taken for culture and sensitivity testing taken
218 at the time of the parotidectomy found profuse growth of *Klebsiella oxytoca* and the
219 contamination of the area was likely a contributing factor in the wound breakdown. Another
220 patient developed an abscess 7 months postoperatively; on exploration of the abscess a small
221 part of a penrose drain was found likely responsible for the abscessation.

222

223 The 2 patients that developed permanent facial nerve paralysis both required revision surgery.
224 However, the facial nerve function was absent after the initial procedure so therefore this can
225 be considered separate from the complication. None of the patients in this study had recurrence
226 of the sialoceles with a median follow-up time of 14 months and thus parotidectomy compares
227 favourably with other surgical techniques in that respect. To our knowledge this is the first time
228 that the complication rate for this procedure has been quantified in a larger group of patients.

229

230 This study had some major limitations. First of all, the retrospective nature of this study made it
231 difficult to get all the relevant information for all the patients. This is especially true because this
232 is a multi-institutional study and not all institutions are equally proficient in retrieving patient
233 information. Secondly, the small number of patients reduces the statistical power of this study
234 and because of the disparity of aetiologies in the current case series, any conclusion on outcome
235 could be biased. The main reason for this is that parotid sialoceles are uncommon and several

236 treatment options are available to deal with it. Only 14 cases were identified over a period of 7
237 years across 6 busy referral hospitals.

238 Furthermore, not all procedures were carried out by the same surgeon and this difference in
239 surgical experience could have given rise to different outcomes.

240 Despite all of these shortcomings, the authors feel that this study brings useful information to
241 the scientific community and can help surgeons in their decision-making and client
242 communication when they come across this unusual condition.

243

244

245 **CONCLUSION**

246 Although historically complete parotidectomy for the treatment of a parotid sialocele has been
247 considered a technically challenging procedure with a high complication rate, this study has
248 found that in the hands of an experienced surgeon the procedure has a good success rate with
249 good long-term resolution of the clinical symptoms.

250

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254

255 **CONFLICTS OF INTEREST**

256

257 Figure legend:

258 Figure 1. Transverse CT image of the head taken after intra-venous contrast injection. A large,
259 well-delineated hypo-attenuating fluid-filled structure can be seen in the ventral aspect of the

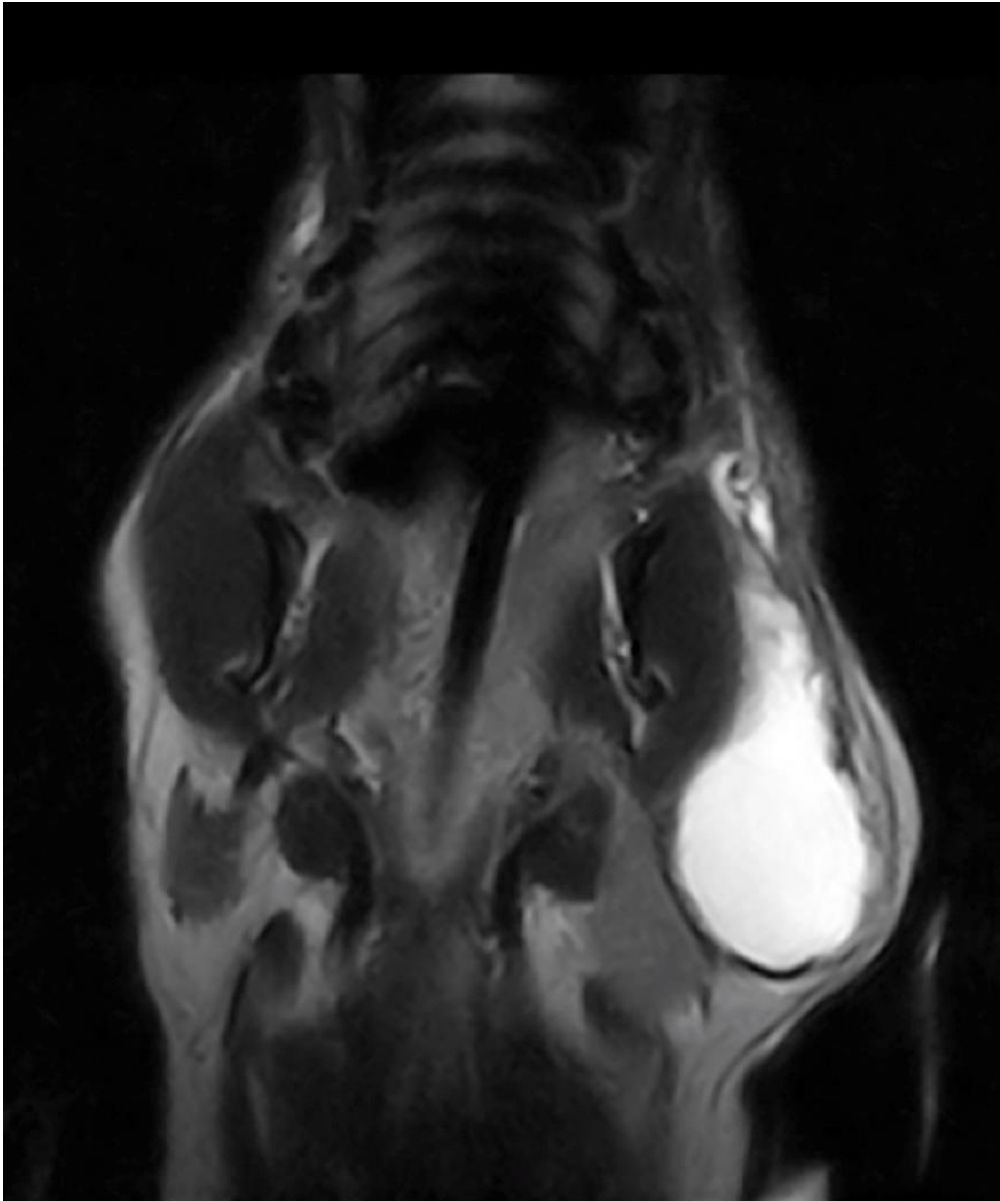
260 head consistent with a parotid sialoceles. Several small-sized mineralised bodies are seen in the
261 dependent part of the lesion consistent with sialoliths

262



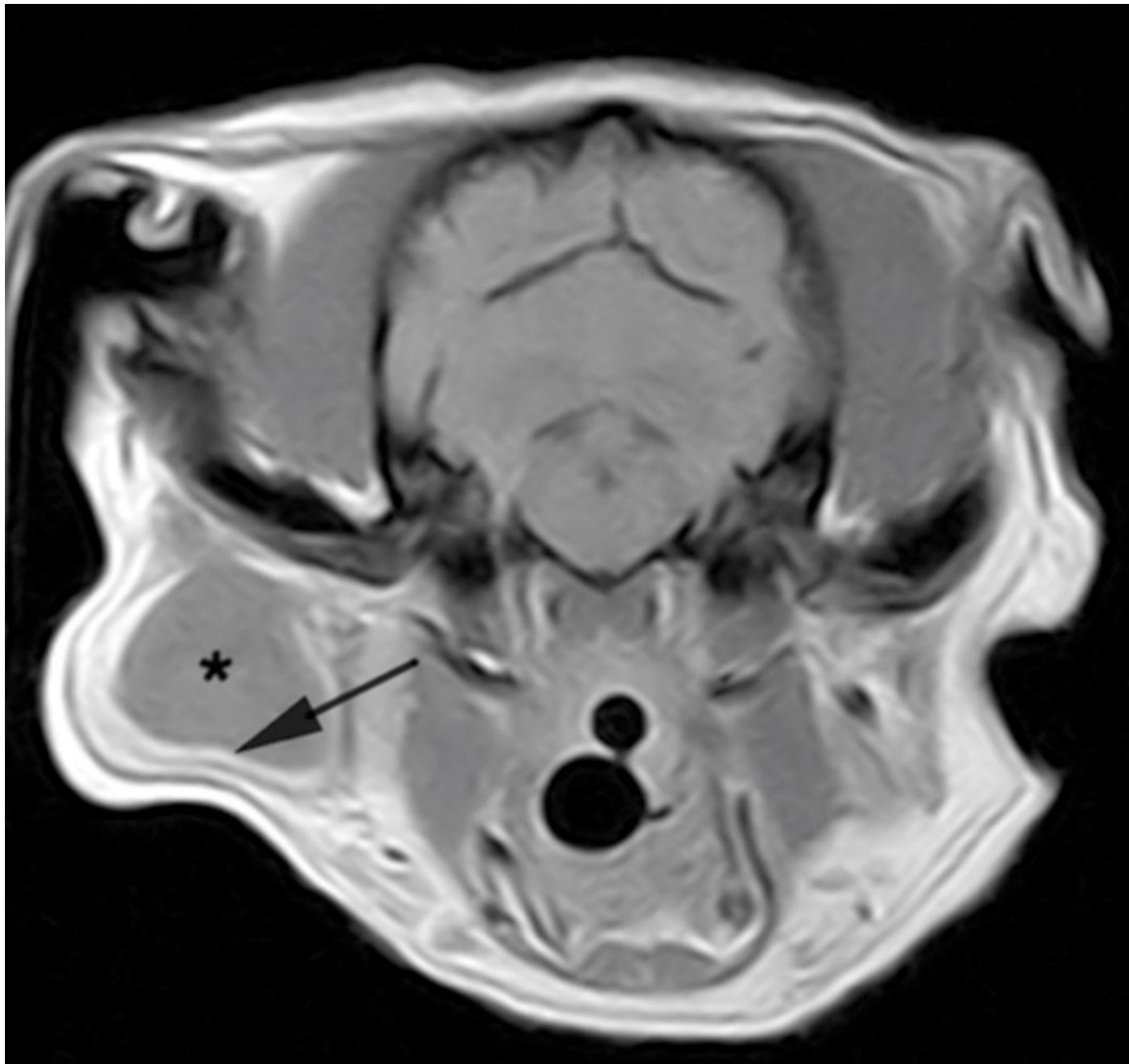
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264 Figure 2. T2-weighted dorsal image of patient with a parotid sialocele. There is a well-defined
265 collection of fluid ventral to the ear in the region of the parotid gland, which extends rostrally
266 along the cheek following the path of the parotid duct
267



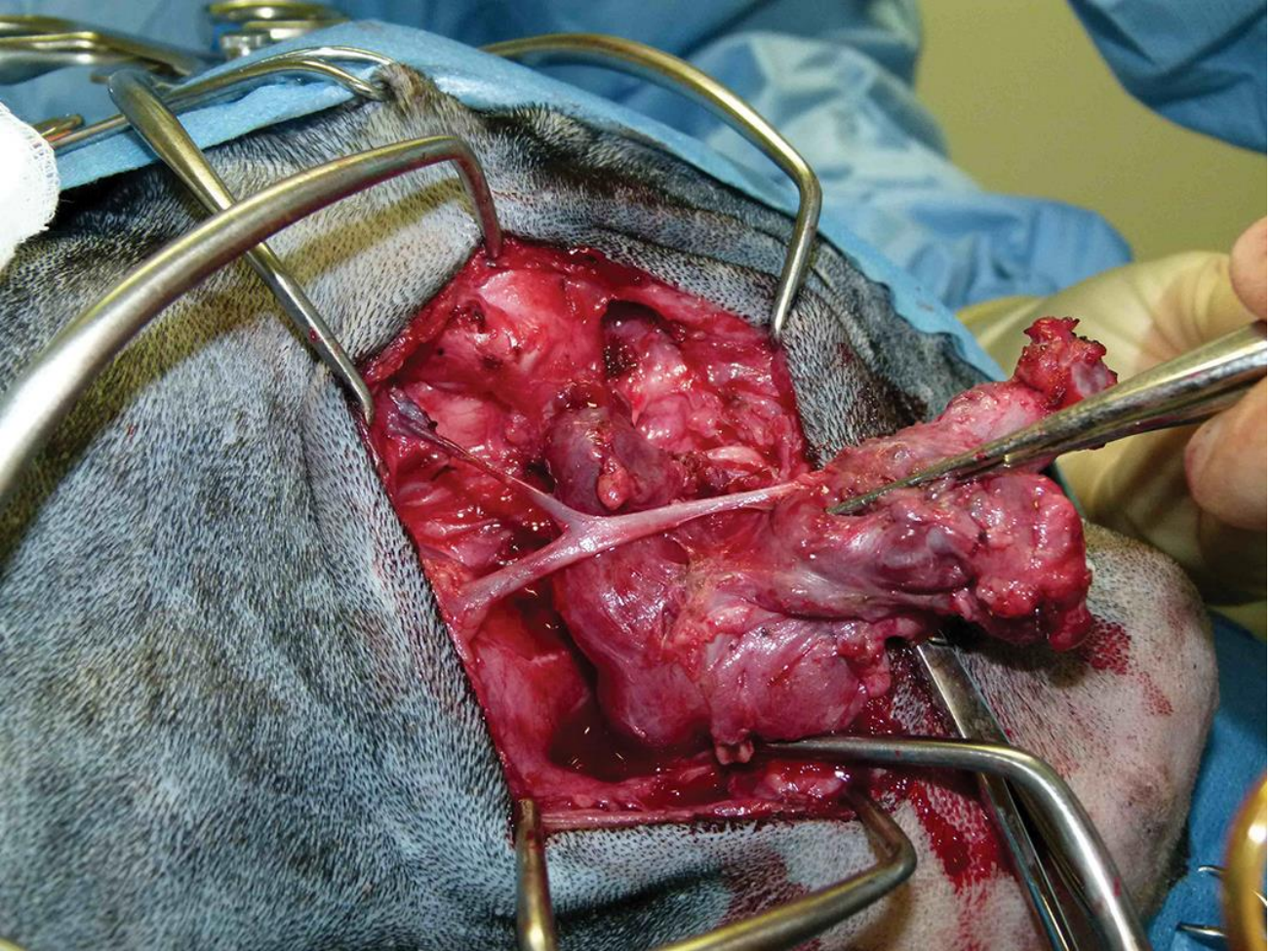
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272 Figure 3. T1-weighted, post-contrast, transverse MRI image of patient with a parotid sialocele.
273 A well-defined collection of fluid ventral to the right ear can be seen (*). There is enhancement
274 of the wall (arrow) of the lesion post-contrast injection consistent with a sialocele.
275



276
277

278 Figure 4. Intra-operative photograph demonstrating the intimate association of the parotid
279 capsule with its surrounding structures including the maxillary and temporal arteries
280



281

282

283

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