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# In Practice

## **Pseudomonas otitis in dogs: a GP's guide to treatment**

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# 1 Pseudomonas otitis in dogs: a GP's guide to treatment

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## 3 **Biographies**

4 **Natalie Barnard** graduated from the Royal Veterinary College (RVC) in 2001 and spent two  
5 years in small animal practice. She returned to the RVC in 2003 as a resident in veterinary  
6 dermatology. She attained the RCVS Certificate in Veterinary Dermatology in 2006 and the  
7 European Diploma in Veterinary Dermatology in 2009. She is currently clinical fellow in  
8 veterinary dermatology at the University of Bristol.

9 **Competing interests** – Over the past five years you have lectured for Zoetis and Elanco.

10 **Aiden Foster** graduated from the University of Bristol in 1987. He is currently senior teaching  
11 fellow in veterinary dermatology and pathology at the University of Bristol.

12 **Competing interests** – none declared.

## 13 SUMMARY

14 This article will cover an approach to the management of canine *Pseudomonas* otitis. It aims to  
15 provide a practical approach to the management and investigation of these challenging cases.  
16 The aetiology of otitis including predisposing, primary, secondary and perpetuating factors will  
17 be discussed. Diagnostic tests including cytology samples and swabs for culture and sensitivity  
18 will be discussed, as will interpretation of your results. Treatment of otitis externa and otitis  
19 media cases will be covered detailing the advantages and disadvantages of various systemic  
20 and topical treatments and when each is appropriate.

## 21 INTRODUCTION

22 Otitis externa in dogs is a very common clinical problem encountered in general practice; it is  
23 also a very frustrating one to treat especially when cases are recurrent. Many organisms can be  
24 implicated in cases of otitis including Gram-positive cocci, Gram-negative rods such as  
25 *Pseudomonas* and the yeast *Malassezia pachydermatis*. This article will focus on the  
26 investigation and treatment of cases of *Pseudomonas* otitis.

1  
2  
3 27 *Pseudomonas spp.* are ubiquitous Gram-negative bacilli, which occur widely in water, soil and  
4  
5 28 decaying organic matter. They are transient organisms of the canine skin and opportunistic  
6  
7 29 invaders on pathological processes such as otitis. *Pseudomonas aeruginosa* is the most common  
8  
9 30 Gram-negative isolate in cases of canine otitis. This bacterium is a particular problem in cases  
10  
11 31 of otitis because the strains involved can be resistant to antibacterial drug treatment (Cole and  
12  
13 32 others 1998). *Pseudomonas* organisms have a complex array of virulence factors and resistance  
14  
15 33 mechanisms that make them a substantial challenge in human and veterinary medicine  
16  
17 34 (Alhamzi 2014).

### 18 19 35 AETIOLOGY

20  
21 36 The causes of otitis can be classified into predisposing, perpetuating, primary and secondary  
22  
23 37 factors (Table 1). In chronic cases of otitis it important to recognise that more than one of these  
24  
25 38 factors may be present and contributing to the patient's disease. It is vital when dealing with  
26  
27 39 cases of otitis externa/media that these factors are addressed to prevent a recurrence of the  
28  
29 40 condition and to aid resolution of the otitis.

30  
31  
32 41 Otitis externa if not treated appropriately can progress into chronic disease. It is this prolonged  
33  
34 42 inflammation of the ear canal which then modifies the microenvironment within the ear and  
35  
36 43 leads to a change in the bacterial population, which in turn causes changes to the structure of  
37  
38 44 the ear canal such as stenosis and glandular hyperplasia leading to increased cerumen  
39  
40 45 production. This in conjunction with the prolonged use of topical antibacterial treatment can  
41  
42 46 lead to the development of a bacterial population with a less predictable sensitivity pattern such  
43  
44 47 as *Pseudomonas*. It is beyond the scope of this article to discuss in depth the aetiology of otitis  
45  
46 48 and readers are referred to standard dermatology texts (Harvey & Paterson 2014; Paterson  
47  
48 49 2016).

49  
50 50 *Pseudomonas* is a Gram negative rod that is not usually isolated from normal dog's ears; it can  
51  
52 51 account for up to 35% of cases of otitis externa and or media (Cole and others 1998).  
53  
54  
55  
56  
57  
58  
59  
60

## 52 HISTORY & CLINICAL SIGNS

53 Dogs suffering with otitis caused by *Pseudomonas* sp. will often present with an acute onset  
54 painful ear with a large amount of purulent exudate, one or both ears can be affected. Often the  
55 ear canal may be ulcerated. Ulceration is not commonly seen in cases of otitis caused by yeast  
56 organisms. When the condition is chronic you may also see lichenification, hyperpigmentation  
57 and excoriation of the pinna; it may not always be immediately apparent from the initial  
58 examination that *Pseudomonas* infection is present (Figures 1 to 6). Otoscopy may not be  
59 possible without sedation or anaesthesia due to pain caused by otitis. Other clinical signs that  
60 may be seen or reported include:

- 61 • Head shaking
- 62 • Odour
- 63 • Head tilt
- 64 • Pain when opening the mouth or swallowing
- 65 • There may be other signs of skin disease, such as pedal pruritus, saliva staining of the  
66 feet, history of recurrent pyoderma
- 67 • Vestibular signs – seen in some cases of otitis media
- 68 • Loss of hearing

### 69 General physical examination

70 This should be performed in all cases. Lymphadenopathy may be present and it is important to  
71 check for any neurological deficits (head tilt, facial paralysis, nystagmus etc.) in cases where  
72 otitis media is suspected.

### 73 Dermatological examination

74 Examine the whole patient as you may find evidence of more generalised skin disease. Atopic  
75 dermatitis is a common cause of recurrent otitis (Jaeger and others 2010) and many animals  
76 with ear disease do have signs of generalised pruritus when examined closely. Identifying these  
77 signs gives important clues as to the primary factor which needs to be controlled to prevent a  
78 recurrence of the otitis.

## 79 DIAGNOSTIC TESTS

### 80 Cytology

81 In the authors' opinion cytology is vital and should be performed in all cases of otitis externa. It  
82 is often better tolerated than otoscopy and so it is the author's preference to perform this prior  
83 to examining the ear with an otoscope. By examining an ear cytology sample we can determine  
84 what type of organisms (coccoid bacteria, rod shaped bacteria or *Malassezia*) are present in the  
85 ear. This enables us to make a more rational treatment plan, decide when to send a swab for  
86 culture and also helps to follow up treatment.

87 Ideally ear cleaner and or medication is not applied to the ear canal on the day that a sample is  
88 taken for cytology or culture.

89 See (BOX 1) for details on how to perform this procedure.

### 90 Otoscopy

91 This can be very challenging to perform conscious in cases with very painful ears. Often  
92 sedation or anaesthesia is required. If the animal will not tolerate this procedure then we should  
93 question what we are hoping to achieve from examining an ear that is full of a purulent  
94 exudate. Sometimes re-assessing the patient after a few days treatment with prednisolone for  
95 otoscopy is also good treatment option and may avoid the need for sedation.

96 Otoscopy is often performed with a view to visualising the tympanic membrane as this may  
97 affect treatment options. However it is accepted that it is very difficult to assess the integrity of  
98 the tympanic membrane in cases of otitis without first cleaning the ear and the patient being  
99 heavily sedated or anaesthetised. Many of our patients are very fearful of ear examination  
100 because it has been an unpleasant experience. We should work hard not to make this the case  
101 if possible as ultimately it will make ear examination an easier experience for all concerned  
102 especially when dealing with atopic dogs who may need long term ear treatment. The use of  
103 treats during otoscopy is a good way to distract the patient and may enable easier examination  
104 and make it a more pleasant experience for the dog and owner.

1  
2  
3 105 Culture and sensitivity

4  
5 106 Swabs should be sent for culture and sensitivity whenever rods are seen on cytology as this  
6  
7 107 could indicate a *Pseudomonas* infection. Generally it is best to treat the suspected cases as if  
8  
9 108 they have a *Pseudomonas* infection when rods are seen on cytology, while awaiting results, as  
10  
11 109 this is often the best chance to resolve the infection.

12  
13  
14 110 TEXT BOX 1: Interpreting culture and sensitivity results

15  
16 111 It is important to remember that bacterial culture sensitivity reports are based on the amount of  
17  
18 112 antibacterial drug in serum concentrations required to kill the organism. This has implications  
19  
20 113 when selecting a systemic treatment to deal with a case of otitis media, but may not be  
21  
22 114 relevant when using topical treatments, because these are applied to the ear in much greater  
23  
24 115 concentrations than those tested and still may be effective especially when their use is  
25  
26 116 combined with a product like Tris-EDTA.

27  
28 117 See Nuttall 2016 for a more detailed appraisal of how to interpret test results.

29  
30  
31 118 It is important to remember that in the majority of cases of otitis externa and media topical  
32  
33 119 treatment is the treatment of choice.

34  
35  
36 120 TREATMENT

37  
38 121 Once a *Pseudomonas* otitis externa/media has been identified it should be treated aggressively  
39  
40 122 and the owners should be warned that treatment can in some cases be lengthy and require  
41  
42 123 several follow up appointments to check on progress. In some chronic cases it is not unusual for  
43  
44 124 treatment to take 6 – 8 weeks with frequent revisits every two weeks to monitor the patient's  
45  
46 125 progress. When discussing the treatment options with a client it is important to take into  
47  
48 126 consideration client and patient factors. For example financial considerations, can the owner  
49  
50 127 actually medicate the dogs ear (?), are the clients committed to make frequent revisits? In the  
51  
52 128 authors' opinion the success of managing these cases especially when they are chronic is largely  
53  
54 129 influenced by the owner's commitment and dedication to medical management which can be  
55  
56 130 time consuming and labour intensive.

57  
58 131  
59  
60

1  
2  
3 132 To date the quality and quantity of studies that have been performed to evaluate treatments for  
4  
5 133 *Pseudomonas* otitis are low and so most therapeutic decisions are based on inadequate  
6  
7 134 published data, personal experience and anecdote, rather than on a solid evidence base (Nuttall  
8  
9 135 & Cole 2007) This should be borne in mind when reading this and other articles.

10 136

11  
12 137 The aims of treatment are:13  
14 138 1) Eliminate the *Pseudomonas*15  
16 139 2) Reduce the inflammation present in the ear canal and therefore prevent the production  
17  
18 140 of further exudate19  
20 141 3) Clean the ear – to remove the mucopurulent exudate21  
22 142 4) Prevent a recurrence by addressing any primary, predisposing and perpetuating factors.23  
24 143 This includes reversing any chronic changes if possible to change the environment in the  
25  
26 144 ear canal so it is not supportive for the *Pseudomonas* bacterium.27  
28  
29 145 1 ELIMINATE THE *PSEUDOMONAS* ORGANISM30  
31 146 Our main aim is to eliminate the *Pseudomonas* bacterium which is causing the infection. Topical  
32  
33 147 treatment for these cases remains the treatment of choice due to the poor blood supply to the  
34  
35 148 ear canal and therefore relatively low amounts of antibacterial drug that actually reach the ear  
36  
37 149 when it is given parentally. However the exception to this rule is when cases have neurological  
38  
39 150 signs associated with their otitis media. In these cases topical treatment should generally be  
40  
41 151 avoided if possible because it may exacerbate the neurological signs.42  
43  
44 152 *What's available to eliminate the Pseudomonas?*45  
46 153 There are two main categories of treatments available, namely antibacterial drugs and  
47  
48 154 antiseptics.49  
50 155 ANTIBACTERIAL DRUGS51  
52 156 The following drugs are available in current topical ear products in the U.K. and would be  
53  
54 157 suitable to treat cases of *Pseudomonas* otitis:

- 55
- 
- 56 158 • Marbofloxacin (Aurizon®: Vetoquinol, Marbodex®: Norbrook Laboratories
- 
- 57
- 
- 58 159 • Orbifloxacin (Posatex®: MSD)



- 160 • Gentamicin (Otomax®; MSD, Easotic®; Virbac)
- 161 • Polymixin B (Surolan®; Elanco)

162 It should be noted that none of these products are licensed to be used in an ear when the  
163 tympanic membrane is ruptured. See below for details of managing cases of otitis media.

164 Fluoroquinolones such as enrofloxacin, marbofloxacin and pradofloxacin and are commonly used  
165 in veterinary medicine in the U.K, but should generally be reserved for the more resistant  
166 infections. They are bactericidal and inhibit the bacterial gyrase enzyme responsible for DNA  
167 synthesis. The bactericidal activity of the fluoroquinolones is concentration dependent and this  
168 makes them a good choice for topical treatment of cases of *Pseudomonas* otitis. Their action  
169 can be potentiated by using a Tris-EDTA containing product prior to applying the medication.  
170 Some studies when using these drugs orally to manage cases of *Pseudomonas* otitis that off  
171 label higher dose rates have been more effective, but as discussed generally topical treatment  
172 is preferred and more effective.

173 Polymixin B should be effective in managing cases of *Pseudomonas* otitis, however in the  
174 authors' experience in the U.K, success with this treatment seems to be fairly limited, many  
175 isolates appear to be resistant to this treatment and there are no current, accepted, guidelines  
176 for assessing the antibacterial resistance of veterinary isolates of *Pseudomonas* (laboratory  
177 recommendations are usually based on guidelines for the interpretation of results for human  
178 isolates).

179 Aminoglycosides such as gentamicin and tobramycin are reported to be effective against  
180 *Pseudomonas* isolates and can be used as topical therapy in these cases. These antibacterial  
181 agents exert their action by inhibiting bacterial protein synthesis. Their action is optimal in an  
182 alkaline environment and they can be inactivated by purulent material, so will work best in a  
183 clean ear. Using these agents in combination with a product containing Tris-EDTA will potentiate  
184 their action. Otitotoxicity is often a concern when using these medications especially gentamicin. It  
185 should be noted that ototoxicity from topical gentamicin did not occur in any dogs after  
186 deliberate rupture of the tympanic membrane (Strain and others 1995).

## 187 ANTISEPTICS

188 Benefits have been reported when using a product containing acetic acid and boric acid  
189 (Malacetic®; Dechra) as a soak in affected ears. Generally, given that the ear canals are  
190 ulcerated and painful this sort of product should be applied in a heavily sedated or  
191 anaesthetised patient.

## 192 Tris-EDTA (TRizAural®; Dechra)

193 This product contains Tris-EDTA in alkaline solution. This can be very useful when treating cases  
194 of *Pseudomonas* otitis. It affects the cell membranes of the bacterium by chelating minerals  
195 such as calcium and magnesium, essentially stripping off the outer membrane layer, rendering  
196 the membranes more porous so that antibacterial drugs can diffuse into the bacteria and kill  
197 them. This may also indirectly interfere with the efflux pump mechanism by chelating the  
198 calcium ions required for the pump mechanisms.

199 Even if culture and sensitivity indicate that a Gram-negative bacterium is resistant in vitro to a  
200 certain antibiotic, pre-treatment with Tris-EDTA may make the organism sensitive to the  
201 antibiotic in vivo. Clinically this product should be used as a pre-treatment solution 20 to 30  
202 minutes prior to applying topical antibiotic treatment. It is most effective when used in  
203 combination with fluoroquinolones and gentamicin (Buckley and others 2013).

## 204 Silver sulphadiazine (Flamazine cream®: Smith and Nephew)

205 This product is a human topical agent used to treat patients with burns and is not licensed for  
206 use in animals in the U.K. Silver sulphadiazine is active in vitro against *Pseudomonas*  
207 *aeruginosa* and a 1% preparation has been reported to be useful when treating some cases of  
208 *Pseudomonas* otitis. In the UK this product is available as a cream and should be mixed with  
209 saline to make a suspension which can then be used topically in the ear. This has not been  
210 found to be ototoxic and so can be used in cases of otitis media. It is suggested to mix 1.5 mls  
211 with 13.5 mls of saline, which is then mixed well to make a uniform suspension (Foster &  
212 DeBoer 1998). Generally 1-2 mls would be applied to the affected ear twice daily. When giving

213 this mixture to clients it must be stressed to mix the suspension well before applying it to the  
214 patient.

215 What to use if the tympanic membrane is ruptured?

216 Otitis media is extremely common in cases of *Pseudomonas* otitis and so this is a common  
217 therapeutic dilemma. Imaging of the ear is useful to identify if otitis media is present, but  
218 unfortunately radiographs are quite insensitive at detecting changes in the bulla and generally a  
219 CT Scan or MRI will be more sensitive. Pathological abnormalities of the tympanic bulla and  
220 external ear canal seen using the various imaging modalities can be a prognostic indicator in  
221 some cases; i.e. it may reflect that those cases could be more difficult to manage medically and  
222 possibly surgical management should be considered. There are currently no topical products  
223 licensed to treat otitis media in the dog, although it is still accepted that topical treatment is the  
224 best way to manage these cases, providing they do not have any neurological signs. If  
225 neurological signs are present, with the exception of flushing the ear with saline, systemic  
226 treatment is preferred (see box on systemic treatment).

227

228 There are many different treatments proposed in the literature for dealing with these cases  
229 ranging from the use of acetic acid flushes to using injectable fluoroquinolone solutions  
230 topically. Each case should be treated as an individual. Discussing cases with an experienced  
231 clinician, who is used to dealing with these cases, such as a RCVS specialist in veterinary  
232 dermatology, may be useful. Below are some suggested treatments that can be used when the  
233 tympanic membrane is ruptured. Please be aware that these products are being used off  
234 licence, including the use of some drugs employed in human medicine, clients should be warned  
235 of possible adverse effects before using them and sign a consent form for off-label use.  
236 Whenever off license treatments are used to treat otitis media cases should be regularly  
237 monitored and clients advised to discontinue treatment and contact the practice if there are any  
238 problems, specifically neurological side effects.

- 239 • Injectable enrofloxacin solution (Baytril®; Bayer 2.5%): water for injection in a 1 : 4  
240 ratio. This is the author's preferred way to use this product, however in the literature

241 various different ratios and combinations are used. Ideally instil 0.5-1 ml of the solution  
242 into the dog's ear twice daily.

- 243 • Gentacin® eye/ear drops – this is a human product which can be used topically in the  
244 ears.
- 245 • Flamazine® suspension – as described above.
- 246 • TRizAural flushes – have been used in cases where the tympanic membrane is ruptured.
- 247 • Ticarcillin has been successfully used in these cases, it is no longer available.
- 248 • In cases with a ruptured tympanic membrane if you feel topical glucocorticoid would be  
249 beneficial dexamethasone sodium sulphate injectable (Rapidexon; Dexadrosson) can be  
250 diluted 1:1 with water for injection or saline and a volume of 0.25-0.5 ml can be instilled  
251 into the ear after flushing (Harvey & Paterson 2014).

#### 252 TEXT BOX 2 Systemic treatment of otitis media

253 Systemic treatment is generally only used when there are neurological signs or topical  
254 treatment is not possible. In these cases your culture and sensitivity results become very  
255 important because if we use systemic antibiotics alone in cases of otitis media it relies on lower  
256 level of antibacterial agents reaching the middle ear through the blood stream or inflammatory  
257 cells. Fluoroquinolones such as enrofloxacin and marbofloxacin are suitable to treat cases of  
258 otitis media, but even at the maximal doses may not be high enough to deal with very resistant  
259 infections.

260 Topical treatment for otitis media is still the preferred way to treat these cases, because of the  
261 high level of drug that can be used topically and the relatively poor drainage of the ear canal.

## 262 2 REDUCING INFLAMMATION

263 The best way to reduce inflammation in cases of otitis is to use glucocorticoids these can be  
264 used both topically and systemically. The author will use systemic glucocorticoids in most cases  
265 of *Pseudomonas* otitis. Systemic glucocorticoids, reduce both intense pruritus, inflammation and  
266 ulceration of the ear canal. Doses typically used range from 0.5-1 mg/kg once daily for a  
267 minimum of 10-14 days to reduce the stenosis and oedema of the external ear canal. Topical

268 corticosteroids are also very useful when managing these cases. Most of the commercial ear  
 269 drops contain a topical corticosteroid with variable potency.

270 Below is a table showing the types of steroids included in current topical ear preparations and  
 271 their relative potency compared to hydrocortisone which is given a potency of 1.

STEROID	POTENCY	PRODUCT
Prednisolone	4	Surolan®, Canaural®
Dexamethasone	25	Aurizon®, Marbodex®
Betamethasone	25	Otomax®
Hydrocortisone aceponate*	>25	Easotic®
Mometasone *	>25	Posatex®

272  
 273 \* Mometasone and hydrocortisone aceponate are considered to be more potent steroids than  
 274 betamethasone and dexamethasone.

### 275 ANALGESIA

276 Using steroids will reduce the inflammation present in the ear canal but it is not an analgesic.  
 277 Non-steroidal anti-inflammatories do not clinically seem to be very effective at managing pain in  
 278 these patients and obviously should not be given with glucocorticoids; often opiate-based  
 279 analgesics are used if required. If your patient is very painful you may want to consider using  
 280 Tramadol (2-5 mg/kg three times daily) or paracetamol- codeine (PARDALE-V) for analgesia.

### 281 3 EAR CLEANING

282 Ear cleaning is vitally important when dealing with these cases as we are aware that removal of  
 283 the mucopurulent exudate will enhance the effectiveness of some antibacterial treatments such  
 284 as gentamicin and polymixin B. However we do need to be careful not to over clean the ear  
 285 because this will cause irritation and maceration of the ear canal and make the infection harder  
 286 to resolve. There are many ear cleaning products on the market and most have a good  
 287 antibacterial action. It is beyond the scope of this article to discuss ear cleaners in detail. Below  
 288 are some general rules:

1  
2  
3 289

4 290 • An ear flush under general anaesthesia is a good way to remove a large amount of  
5  
6 291 debris and also allows assessment of the tympanic membrane. Generally we would  
7  
8 292 advise ear flushing in most cases of *Pseudomonas otitis*. (box 2).

9  
10 293 • Limit the use of ear cleaners daily to 14 days and then reduce the frequency to 1 -2  
11  
12 294 times weekly as this will prevent maceration of the ear canal epithelium.

13  
14 295 • Be aware of contact reactions with ear cleaners and consider changing products if the  
15  
16 296 dog is not tolerating the ear cleaner or the owner reports excessive discomfort shortly  
17  
18 297 after using them.

19  
20 298 • When selecting an ear cleaner, consider the pH of the product you are using. For  
21  
22 299 example if a dogs ear canal is very ulcerated then a very acidic or alkaline cleaner may  
23  
24 300 cause a lot of discomfort in the early stages of treatment.

#### 25 26 27 301 4 IDENTIFY & MANAGE THE PRIMARY FACTOR/S THAT CAUSED THE PROBLEM

28  
29 302 It is important to identify the primary, perpetuating and predisposing factors in every case and  
30  
31 303 ensure that all factors are addressed to prevent a recurrence of the problem. In recurrent cases  
32  
33 304 of otitis an allergy investigation should be considered including a dietary trial.

#### 34 35 36 305 **Potential problems when treating cases of *Pseudomonas otitis***

##### 37 38 39 306 • **Managing owners expectations**

40  
41 307 ○ Advise at the beginning of treatment if *Pseudomonas* is isolated and the problem has  
42  
43 308 been going on for some time it may take at least 6 – 8 weeks of treatment to  
44  
45 309 resolve the problem

46  
47 310 ○ Advise them at the start if ear disease has been a recurrent problem that  
48  
49 311 investigating the underlying cause will be essential to preventing relapses in the  
50  
51 312 future.

##### 52 53 313 • **Owner compliance**

54  
55 314 ○ Consider using a syringe to apply medication to the ear to enhance owner  
56  
57 315 compliance. Patients seem to readily tolerate medication being applied in this way.

316           ○ Always demonstrate the use of ear cleaners to clients and also demonstrate how to  
317           apply ear drops.

318   • **Infection recurs when treatment is discontinued**

319           ○ Most commonly this occurs because treatment is stopped too early, always aim to  
320           treat for at least 7 – 10 days past cytological cure and then re-assess the patient 7-  
321           10 days after discontinuing the antibiotic treatment.

322           ○ Primary, predisposing and perpetuating factors may not have been adequately  
323           addressed.

324           ○ Often ear cleaning will need to be continued for many months to allow the normal  
325           cleaning mechanisms of the ear to recover. If the infection has been particularly  
326           severe or prolonged then ear cleaning may need to be continued indefinitely.

327 **FOLLOWING UP THE CASES AND ON GOING MANAGEMENT**

328 In the authors opinion these cases should be re-examined every 10-14 days and cytology  
329 repeated at each visit. Owners will often report the dog is completely recovered, but without  
330 repeating cytology and otoscopy it is impossible to judge when treatment can be stopped. It is  
331 not uncommon for *Malassezia* to be seen on cytology samples at revisit examinations, generally  
332 the authors consider this to be a good sign and recovery of the normal flora, but excessive  
333 numbers may need to be controlled with appropriate treatment.

334 **When to consider surgery as a treatment option?**

335 Surgical intervention such as a total ear canal ablation and bulla osteotomy should be  
336 considered when:

- 337           • Medical treatment fails
- 338           • When medical treatment is not possible due to client or patient factors; i.e. the client is  
339           unable to apply topical medication, financial limitations.
- 340           • There are severe secondary changes to the ear canal making medical management  
341           difficult or unlikely to succeed such as calcification of the external ear canal or chronic  
342           otitis media with structural changes to the bulla.

## 343 SUMMARY

344 *Pseudomonas* otitis is perhaps the most challenging infection of the ear to manage, because it is  
345 intrinsically resistant to many antimicrobial drugs and it thrives in an environment created by  
346 chronic inflammatory changes in the ear canal. It is important in these cases that we treat them  
347 aggressively at first presentation and address any predisposing, primary, secondary or  
348 perpetuating factors that may be present. Successful management of these cases is easier with  
349 a dedicated owner and regular re-examinations are vital.

## 350 Further reading

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51  
52 390 **TABLE 1 Predisposing, primary, secondary and perpetuating factors for otitis**

53  
54 391 **Predisposing factors** – these make the chance of developing otitis externa more likely by  
55 392 changing the environment in the ear canal, but alone will not cause otitis externa. These are  
56 393 explored in more detail elsewhere (Paterson 2016). Examples include:

- 1  
2  
3 394 • Conformation – e.g. pendulous ear canals, hairy ear canals, stenotic ear canals (occur  
4  
5 395 naturally in some breeds such as the Shar Pei)  
6  
7 396 • Excessive moisture in the ear – as a result of swimming, excessive use of ear cleaners  
8  
9 397 • Inappropriate treatment – which may traumatise the ear canal

10 398 **Primary factors** – these factors can directly cause otitis externa

- 11  
12  
13 399 • Ectoparasites – *Otodectes*, demodicosis.  
14  
15 400 • Foreign bodies – grass seed  
16  
17 401 • Allergic skin disease (adverse food reaction, atopic dermatitis).  
18  
19 402 ○ **Atopic dermatitis is the most common cause of otitis externa in the dog**  
20  
21 403 • Endocrinopathies - hyperadrenocorticism and hypothyroidism  
22  
23 404 • Immune-mediated disease – e.g. pemphigus foliaceus, juvenile cellulitis  
24  
25 405 • Keratinisation defects – e.g. sebaceous adenitis  
26  
27 406 • Immunosuppression – possible secondary to neoplasia or chemotherapy  
28  
29 407 • Neoplasia within the ear canal

30  
31 408 **Secondary factors** – these factors contribute to or cause pathology in an abnormal ear, but  
32  
33 409 will not create disease in normal ears, examples include yeast and bacterial overgrowth.

34  
35  
36 410 **Perpetuating factors** – these are the changes (anatomically or physiologically) that occur in  
37  
38 411 an ear when chronic otitis is present and make it harder to manage medically. Examples  
39  
40 412 include:

- 41  
42  
43 413 • Stenosis of the ear canal 415 • Epidermal and glandular hyperplasia  
44  
45 414 • Ulceration 416 • Otitis media  
46

47 417 **Box 1: How to perform ear cytology**

48 418 See three figures entitled Ear cytology – cocci; Ear cytology – Malassezia and Ear cytology – rods

49  
50  
51  
52 419 **Equipment required**

- 53  
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55 420 • cotton buds x 2 422 • pencil – to label your slides  
56  
57 421 • glass slides x 2 423 • Diff Quik® or equivalent stain  
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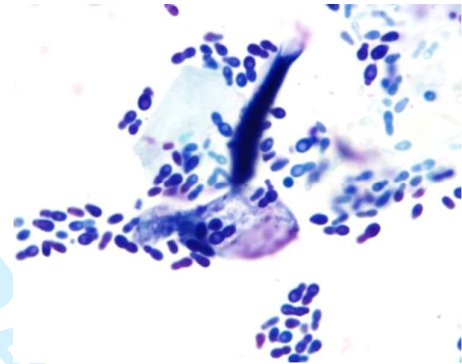
- 424 • Microscope with immersion oil lens 425 • Immersion oil

426 **Taking the sample**

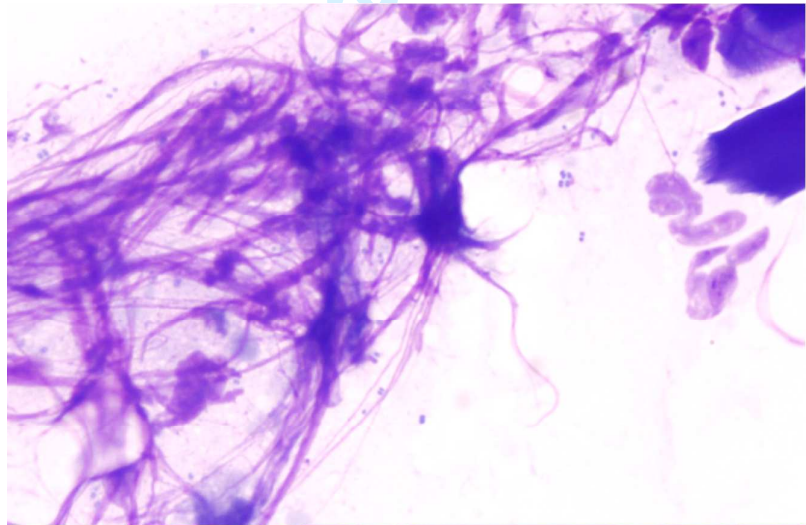
- 427 1. Ensure the dog is relaxed and use treats if needed to obtain the sample.
- 428 2. Carefully place the cotton bud into the dog's external ear canal if possible try to obtain a  
429 sample from the horizontal portion of the external ear canal. If the ear is painful or  
430 stenotic you may only be able to sample the vertical canal.
- 431 3. Remove the cotton bud from the dog's ear and then gently roll it on a glass slide. Label  
432 the slide. Stain the sample using Diff Quik, rinse and allow it to dry.
- 433 4. Once the slide is dry you can examine it using a microscope. Initially select an area of  
434 interest using low power and then use the oil immersion lens to try and identify  
435 inflammatory cells and organisms. Examples of findings are shown below:

436

437 *Malassezia pachydermatis* is shown.  
438 Note the distinctive shape of the  
439 organism often referred to as a foot  
print or snowman when described.  
These organisms are much larger than  
bacteria.



440 Coccoid bacteria  
441 with numerous  
442 neutrophils and  
443 nuclear streaming.



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Rod shaped bacteria  
with numerous  
neutrophils and  
nuclear streaming

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2  
3 447 **BOX 2: Ear flushing** See figures entitled Ear Flush 1 to 5  
4

5 448 **Ear Flushing**

6  
7  
8 449 If an ear canal is full of a purulent or ceruminous exudate it is not possible to assess the  
9  
10 450 integrity of the tympanic membrane, which can be very important when managing a case of  
11  
12 451 *Pseudomonas* otitis. Flushing of the ear canal should be performed under general anaesthesia.  
13  
14 452 In some referral hospitals a video otoscope is used, which enhances visualisation, but in  
15  
16 453 practice you may not have access to this equipment and so here is one technique you can use  
17  
18 454 to flush the ears. Ear flushing is generally time consuming and you should allow approximately  
19  
20 455 20-30 minutes to flush each ear.

21  
22 456 Prior to admitting the patient for an ear flush it is often beneficial for them to have received  
23  
24 457 treatment with a glucocorticoid to reduce the inflammation present and open up the ear canal.  
25  
26 458 The author routinely prescribes prednisolone at 0.5 mg/kg once daily for at least 7 days prior to  
27  
28 459 an ear flush.

30  
31 460 *Equipment required for ear flushing*

- 32  
33  
34 461 • 500 ml bag of sterile saline  
35  
36 462 • Otoscope with two suitable sized heads  
37  
38 463 • Syringes – 2 and 5 mls  
39  
40 464 • Appropriate sized catheter to flush the ear depending on the patency of the ear canal.  
41  
42 465 Cat or dog urinary catheters can be used. The author prefers to use 6F dog catheters.  
43  
44 466 These should then be cut to an appropriate length depending on the size of the patient  
45  
46 467 and the length of their ear canal. The catheter needs to be long enough to pass through  
47  
48 468 the otoscope head and into the ear canal.
- 49 469 • Two bowls, one for the fresh saline and one to place the fluid flushed from the affected
  - 50
  - 51 470 ear.
  - 52

53  
54 471 **Performing an ear flush with a handheld otoscope**  
55  
56  
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60

472 It is important that flushing of the ear is carried out whilst visualising the ear canal so that no  
 473 damage is caused to any structures in the ear.

474 Step 1: Examine  
 475 the affected ear  
 476 with an otoscope  
 477 and take a sample  
 478 for ear cytology if  
 479 not performed  
 480 already. If rods  
 481 are seen on



482 cytology and you have not already taken a swab for bacterial culture and sensitivity you should  
 483 do this prior to flushing the ear. It is useful to clip the hair away from the pinnae and external  
 484 auditory meatus at this stage.

485 Step 2: Prepare your equipment: Take a clean 5 ml syringe and  
 486 attach your pre-prepared urinary catheter cut to the  
 487 appropriate length for the patient to it. Draw up 2-3 mls of  
 488 saline into this syringe.

489 Step 3: Clean the external auditory meatus using some warm  
 490 water and cotton wool.

491 Step 4: Introduce the otoscope into the external ear canal and  
 492 once you are able to visualise as far as possible into the ear,  
 493 move the lens of the otoscope out of the way to enable a catheter to be introduced into the  
 494 otoscope.





1  
2  
3 495 Step 5: Whilst holding the otoscope and pinna in one hand, introduce the catheter into the  
4 496 affected ear and slowly introduce the saline, whilst looking down the ear canal. You will see the  
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6 497 saline fill the ear canal, before it reaches the top of the ear canal, suck back all the fluid you  
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25 498 have introduced and then discard this in the discard bowl. This procedure is repeated until the  
26  
27 499 fluid removed from the ear is clear.  
28

29  
30 500

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32  
33 501 **YOU WILL NOT BE ABLE TO REMOVE ALL THE FLUID INTRODUCED, BUT YOU SHOULD**  
34  
35 502 **BE ABLE TO REMOVE MOST OF IT BECAUSE WE DO NOT WANT TO LEAVE LARGE**  
36  
37 503 **QUANTITIES OF SALINE IN THE AFFECTED EAR.**  
38

39 504 At this stage you should be able to visualise the external ear canal and hopefully the tympanic  
40  
41 505 membrane. If the ear canal is clean and you can't see the tympanic membrane, but can see a  
42  
43 506 black hole, it is likely the tympanic membrane has ruptured.  
44

45  
46 507 STEP 6: Dry the ear as much as possible using cotton buds and then apply your first dose of the  
47  
48 508 chosen treatment.  
49

50  
51 509 **Figure legends**

52 510

53  
54 511 Figure 1

55  
56 512 Mild erythema and thickening of the auditory meatus of a cocker spaniel with chronic otitis  
57  
58 513 associated with Pseudomonas infection.  
59  
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- 1  
2  
3 514 Figure 2  
4  
5 515 Severe otorrhoea in a cocker spaniel with severe otitis externa  
6  
7 516 Figure 3  
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9 517 Dark brown exudate in a dog with otitis external due to Pseudomonas infection.  
10  
11 518 Figure 4  
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13 519 Marked stenosis in a dog with chronic otitis involving Pseudomonas infection.  
14  
15 520 Figure 5  
16  
17 521 Marked thickening and alopecia of the pinna in a dog with chronic otitis  
18  
19 522 Figure 6  
20  
21 523 Severe ulceration and purulent exudate in a St Bernard dog that developed Pseudomonas  
22 524 infection following inappropriate and over zealous cleaning of the ear for "canker"  
23  
24 525

25 526 MCQs

- 26  
27 527 Q 1 Which antibacterial agent is likely to be effective against Pseudomonas isolates?  
28  
29  
30 528 A. Doxycycline  
31  
32 529 B. Fusidic acid  
33  
34 530 C. Marbofloxacin  
35  
36 531 D. Cefalexin  
37  
38 532 E. Trimethoprim-sulfa  
39  
40 533 Answer C  
41  
42  
43 534 Q 2 Which of the following is a primary factor that contributes to otitis?  
44  
45  
46 535 A. Epidermal and glandular hyperplasia  
47  
48 536 B. Pendulous ear canals  
49  
50 537 C. Yeast overgrowth  
51  
52 538 D. Atopic dermatitis  
53  
54 539 E. Excessive use of ear cleaners  
55

56 540 Answer D  
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3 541 Q 3 Which ear product can be applied when the tympanic membrane is ruptured?  
4

5 542 A. Marbofloxacin in Aurizon® or Marbodex®  
6

7 543 B. Orbifloxacin Posatex®  
8

9 544 C. Gentamicin in Otomax® and Easotic®  
10

11 545 D. Polymixin B in Surolan®  
12

13 546 E. Tris-EDTA as TrisAural  
14

15  
16 547 Answer E  
17

18 548 Q 4 When there are signs of otitis externa / media; when should topical therapies be  
19

20 549 avoided?  
21

22  
23 550 A. When there are neurological signs  
24

25 551 B. When there are signs of pruritus  
26

27 552 C. When there are signs of contact irritant dermatitis on application of an ear cleaner  
28

29 553 D. When there are signs of dental disease  
30

31 554 E. When there are signs of liver disease  
32

33  
34 555 Answer A & C  
35

36 556 Q 5 When viewing a cytology sample from an ear canal in a dog with signs of otitis; any rod  
37

38 557 shaped bacteria are most likely to be?  
39

40  
41 558 A *Prevotella*  
42

43 559 B *Pseudomonas*  
44

45 560 C *E coli*  
46

47 561 D *Pasteurella*  
48

49 562 E Staphylococci  
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53 564 Answer B  
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Figure 1

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Figure 2

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Figure 3

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Figure 4

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Figure 5

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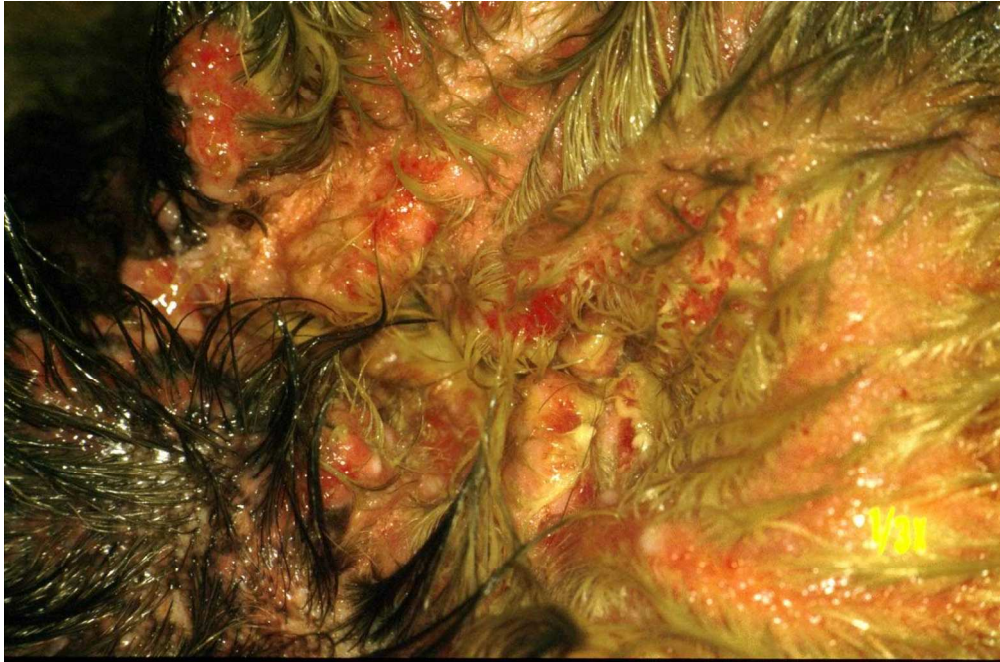
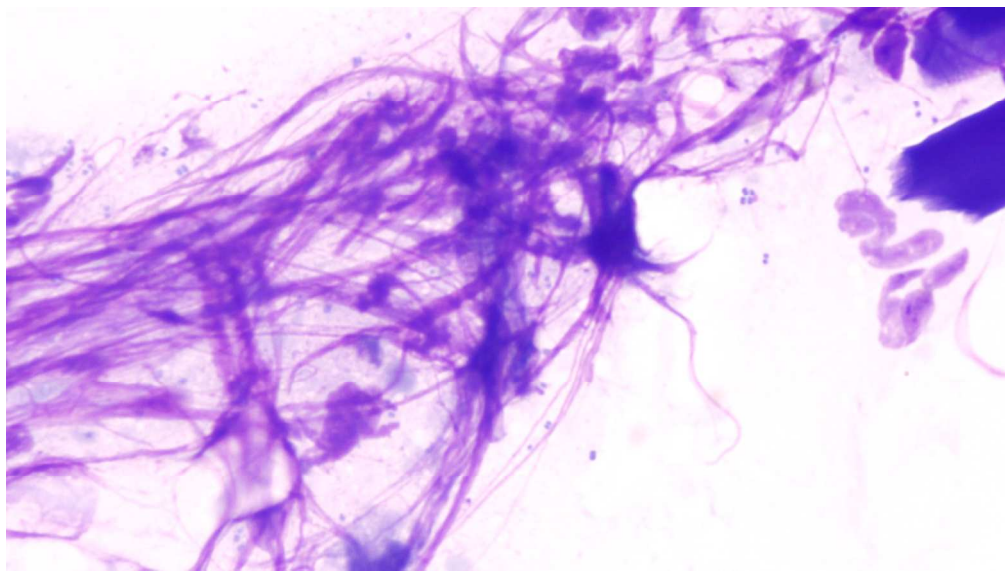


Figure 6

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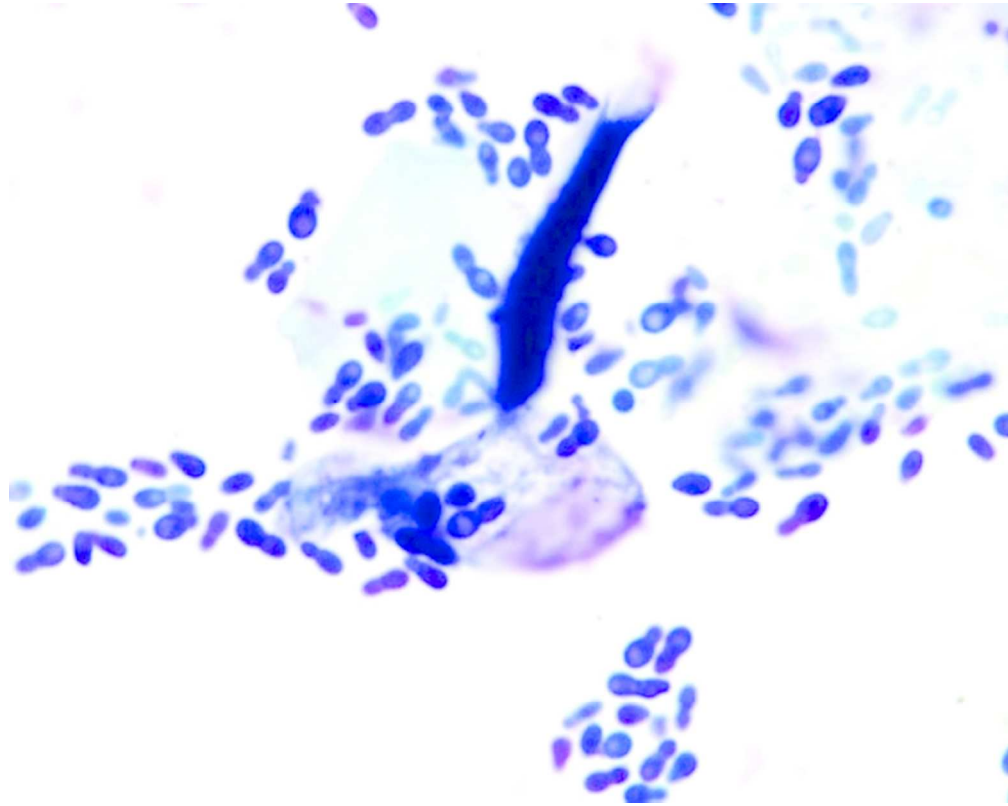
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Ear cytology - cocci

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Ear cytology yeast

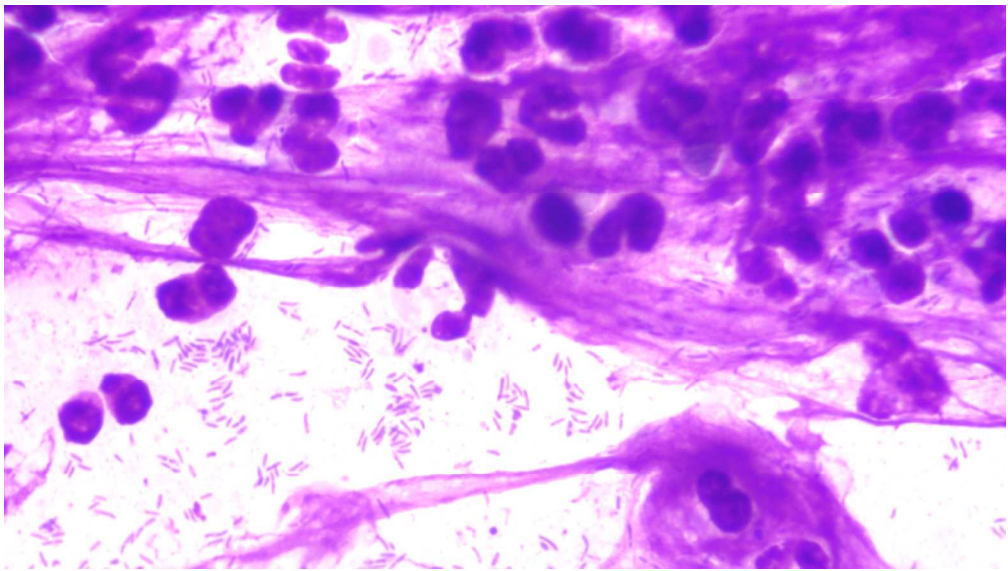
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Ear cytology - rods

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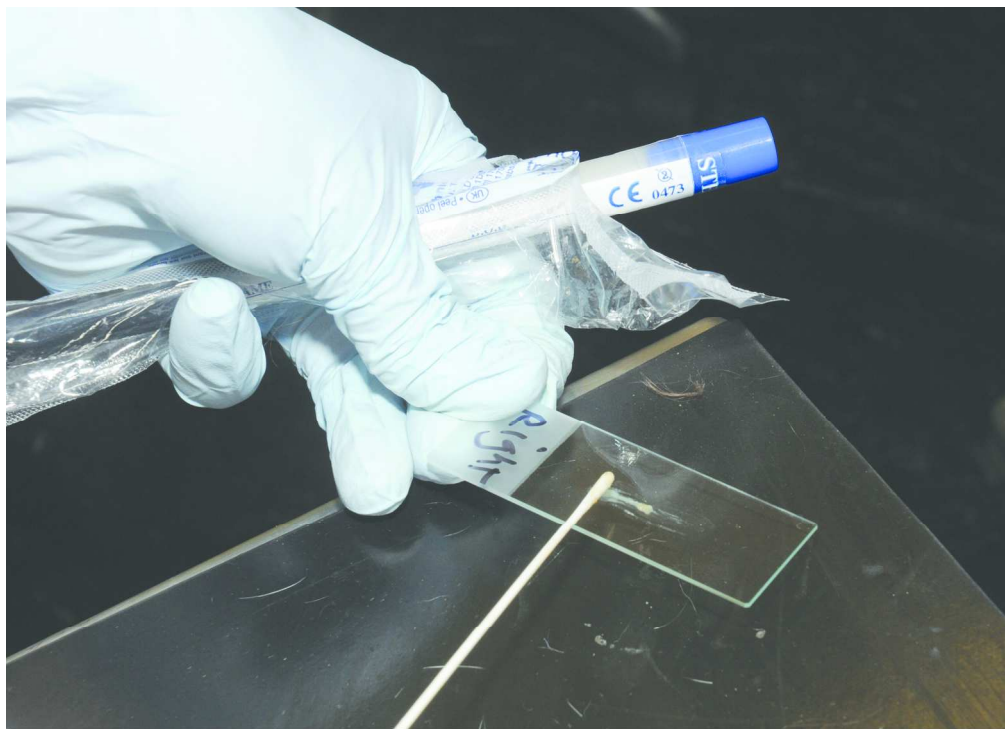


Ear flush image 1

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Ear flush image 2

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Ear flush image 3

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Ear flush image 4

180x124mm (300 x 300 DPI)

Review Only

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Ear flush image 5

180x120mm (300 x 300 DPI)

Review Only