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Correlation of the External Otic Diseases and the Ear Canal Length in Dogs

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개에서 외이도의 길이와 외이도 질환과의 연관성

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요 약 : 외이도의 직경 및 길이와 외이도 질환과의 연관성을 알아보고자 73두 성견을 실험에 이용하였다. 임상증상, 배양 및 도말 검사를 통하여 외이 질환이 없는 정상군 57개의 이관과, 질환이 있는 비정상군 89개의 이관에 직경과 길이를 평가하기 위한 간접적인 방법으로 이관내 조영술을 실시하였다. 비정상군은 정상군에 비하여 윤상연골 및 귓바퀴 연골의 직경이 더 넓었다. 수직외이도를 구성하는 귓바퀴 연골의 길이는 비정상군(12.79±2.08)이 정상군(12.79±5.87 mm)에서 보다 유의성 있게 길게 나타났다($p<0.001$). 심한 외이도 협착증을 보이는 21개의 귀에서는 외이도 질환을 발견할 수 없었으며, 외이도 질환이 심한 귀에 있어서 그 직경과 길이가 정상군에 비하여 넓고 길게 나타났다($p<0.05$). 본 실험의 결과로 보아 외이도관의 협착증과 외이도 질환과는 연관성이 발견되지 않았으나, 환기와 귀내 분비물의 배출을 방해하는 긴 수직외이도를 갖는 귀가 외이도 질환과 밀접한 관계가 있는 것으로 생각되었다.

Key words : dog, canalography, auricular cartilage, annular cartilage, external otitis

Introduction

External otitis is closely related with the anatomical factor such as the diameter of external ear canal and ear type[1,2]. External ear canal is an important factor in determining an animal's risk of developing otitis externa[3,4].

Stenotic ear canal that affects the external otitis results from impaired ventilation and clearance of normal secretion[2]. It may be difficult to find the tympanic membrane otoscopically in some normal dogs and in dogs with stenotic or occluded ear canals[5,6]. The degree of stenosis of ear canal has not been demonstrated and defined in other previous studies. Otoscopic examination is simple, direct and useful method for the evaluation of otic diseases in dogs[7]. Secretions, devitalized and necrotic epithelial cells and debris accumulate in the meatus of affected ear canals. This secretions and debris plus the length and tortuous nature of the external ear meatus make the thorough examination of the meatus difficult[4].

Canalography has a significant diagnostic value of otitis media in dogs. Furthermore, canalography is more sensitive for the diagnosis of otitis media than either otoscopy or plain radiography[8,9]. Very few studies have been conducted on the canalography to detect whether tympanic membrane ruptured. The horizontal ear canal has a simple structure, however, it has not been well discussed about anatomical appearance and characteristics.

The purpose of the present report is to evaluate the correlation of external ear canal and external

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otitic disease in dogs.

Materials and Methods

The dogs were divided into normal group which had not any ear problems and abnormal group which had a external otitis on the basis of clinical signs, otoscopic findings, and microscopic examination of ear materials. Dogs were preanesthetized with a combination of atropine sulfate (0.04 mg/kg) and acepromazine maleate (0.10 mg/kg), given IM. Light surgical anesthesia was induced (12 mg/kg of Ketamine-HCl, given IV), if needed. The dogs were examined through ear canal to tympanic membrane with otoscope, and then ear swabbing was performed for the detection of any bacterial infections with microscopic examination and modified Giemsa stain. Before the canalography, hair was removed, and ear washing with saline was performed gently.

The dogs were placed ventral recumbency. Survey radiographs were obtained prior to contrast view. Each ear canal was filled with 1 milliliter iohexol (Omnipaque: 300 mg Iodine/ml, Nycomed Imaging AS, Oslo, Norway). The vertical ear canal was massaged with routine manner for one minute to distribute into horizontal ear canal. Contrast medium was slowly refilled until the medium was reached at the point of the tragus and massage was reapplied. Dorsoventral radiography was performed on each dog.

The diameter of the annular cartilage was measured from the contrast images at a point of midway between the tympanic membrane and distal end of annular cartilage. The diameter of the auricular cartilage was measured from the radiographic images at the point of midway between the proximal and distal end. The length of vertical ear canal which was formed by tragus to proximal end of auricular cartilage was measured from the fronto-occipital radiographic images. The ratio of annular cartilage diameter to auricular cartilage diameter was computed for each dog and each contrast view.

Results

Canalography was performed on 57 normal ears and 89 abnormal ears. The age ranged from 3 months to 11 years. Of the 73 dogs, there were 7 Pug dogs, 11 miniature poodles, 3 Pekingese, 5 Shi-Tzu, 10 Cocker spaniel, 5 Maltese, 5 Chihuahua, 5 Pomeranian, 10 Yorkshire terrier and 12 Schunauzer. All dogs tolerated the canalography well and did not demonstrate any evidence of ear complication from the contrast media.

On otoscopic examination, waxy and/or thick debris were commonly presented in 95% of the abnormal ears. *Malassezia canis* was predominantly identified with microscopic findings in the 32% of ears. Bacterial otitis, on cytological evaluation of otic exudates, was found in the 21% of ears. In descending order of frequency, bacteria isolated from diseased ears include *Staphylococcus intermedius, Escherichia coli, Staphylococcus sp., Pseudomonas aeruginosa.*

Following canalography, contrast media was visible in ear canal including outline of tympanic membrane and permited to determine the diameter. The measurements of annular, auricular cartilage, and vertical ear canal were recorded and listed in Table 1.

Discussion

In this study, canalography was useful technique for evaluating ear canal including tympanic membrane (Fig 1). Contrast media filled the ear canal space and it was easy to perform. The diameter of ear canal was not recognized the difference in dorsoventral and fronto-occipital view. Both the diameters of annular and auricular canal significantly wider in abnormal group than those of normal group. Vertical length in

Table 1. Measurements of annular diameter, auricular diameter, and vertical length of ear canal

Group(n)	annular diameter (mm) (mean±SD)	auricular diameter	vertical length
normal (57)	3.54±0.78	4.34±0.45	12.79±2.08
abnormal (89)	3.83±0.88†	4.80±0.69ϕ	24.11±5.87ʃ

†: annular diameter $p<0.05$($p=0.46$), ϕ: auricular diameter $p<0.05$($P=0.0001$), ʃ: vertical length $p<0.05$($p=0.0001$). t-test.

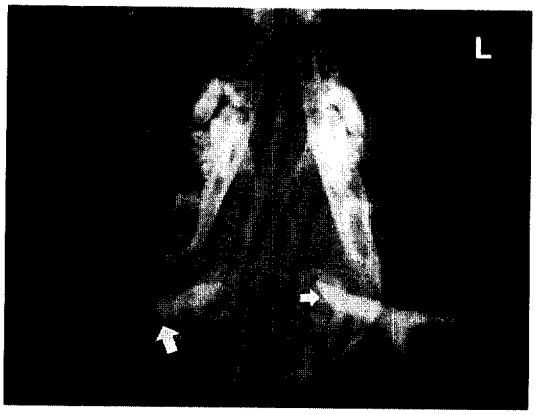

Fig 1. Dorsoventral radiograph of a normal dog during completely filling of contrast media in 5-year-old Chihuahua dog. Note the end of auricular cartilage (large arrow). Straightly oblique line in tympanic bulla considered as a margin of tympanic membrane (small arrow).

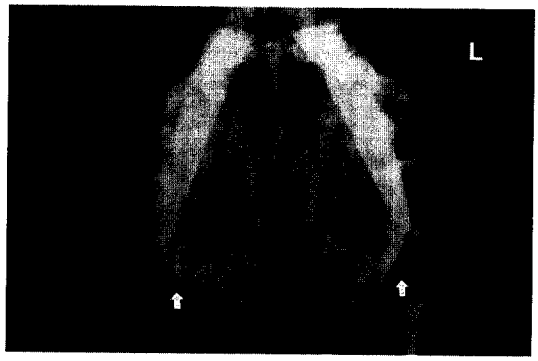

Fig 2. Dorsoventral radiograph of a 4-year-old Pug with a severe stenotic ear canal and without any clinical problems. The diameter of annular cartilage (arrow) was 1.2 mm, but annular cartilage was seen as a normal size. Contrast media was occluded in the ear canal and could not illustrate the tympanic membrane.

abnormal group was longer than that of normal group. The dogs which had a stenotic ear canal were not present any otic diseases. But otic diseases predominantly were detected in dogs which had a long vertical length.

The pathogenesis of otitis externa has not been completely elucidated. Some of the factors that may predispose an animal to ear infections include the presence of hair and polyps in ear canal, type of pinnae, allergy, seborrhea, nutritional and hormonal factors and neoplastic diseases[2]. Ear type is an important predisposing factor in determining an animal's risk of developing otitis externa. Furthermore, stenosis of the ear canal predisposes to recurrent otic infection[2,3]. In this study, stenotic canals, which were too narrow to observe the tympanic membrane with otoscopic findings, were presented in 21 ears and recorded mean diameter 1.98 mm. There was no evidence of otic diseases or complications. Abnormal group had a wider diameter in annular and auricular diameter than that of normal group. Though this condition, otic complications such as infection or inflammation were predominated in abnormal group.

The dogs which were suffered from severe external otitis with bacterial or fungal infection had long vertical canals. The vertical length in abnormal ears was averaged 24.27±5.87mm, it was 2 times longer than that of normal ears. The long ear canal of the dogs is usually narrow and slopes downward at an angle that is not conductive to the normal expulsion of secretion[2]. In this study, however, narrowed ear canal was not identified in dogs which had a long ear canal. Heavy waxy and brown colored materials were accumulated in ear canal, especially at vertical area. The materials were contained *Mallassezia*, bacterial organism, inflammatory cells, other exudates. The pendulous pinnae restricted free circulation of air within the ear canal[3,10]. It was considered that vertical length played an important role as predisposing factors which could evoke the external otic complications. Long vertical canal could disturb the self-sanitization with air circulation or medication. Therefore, bacterial organism including yeasts as a perpetuating factors could be accumulated persistently in waxy or exudate materials[2].

Canalography has been demonstrated for the detection of the ruptured tympanic membrane[8,9]. The distribution of contrast medium may be impaired by exudates or inflammatory tissues in the ear canal or tympanic bulla as to prevent contrast from passing through a ruptured membrane[8]. This technique is more sensitive for otitis media than either otoscopy or survey radiography[9]. Plain radiography is occasionally indicated to evaluate the patency of the ear canal and to determine the extent of ear diseases[6]. It was difficult to discriminate ear canal which had a stenosis

or a heavy wax from soft tissue. Canalography is rapid and simple technique and it may be recommended for evaluating the integrity of tympanic membrane[9]. Although the contrast media could not outline the tympanic membrane in severly stenosed ear or wax materials in 11 ears (Fig 2). Contrast findings have been considered to be more effective and accurate in evaluation of ear canal and tympanic membrane than otoscopic findings. In canalography, ear wax and debris were seen as a sign of filling defect or occlusion of contrast media in the ear canal.

Iohexol, a non-ionic water-soluble iodine contrast medium has no adverse reaction in ruptured tympanic membrane for canalographic study[9]. To clean with saline and then massage the ear canal with pouring contrast media, was useful method for canalography in the ear canal filled with waxy or fluid like inflammatory material. Upright the ear pinnae gently, it may prevent leakage the contrast media from the horizontal ear canal and obtained the radiographic image of tympanic membrane. After radiographic findings, contrast medium was flushed out of the ear with saline solution and no adverse reactions were not observed for one weeks.

Considering from this results, stenotic ear was not correlated with otic diseases in this study, however, vertical length in part of ear canal was important factor in otic complications. It was recognized that canalography was quick and accurate technique for the evaluation of external ear canal include tympanic membrane prior to surgical or medical treatment.

References

1. Krahwinkle DJ. Effect of ear ablation in auditory function as determined by brain stem auditory-evoked responses and subjective evaluation. Vet Surg 1989; 18: 70-75.
2. Agust JR. A disease of multifactorial etiology. Vet Clin North Am 1988; 16: 731-742.
3. Hayes HM, Pickle LW. Effects of ear type and weather on the hospital prevalence of canine otitis externa. Res Vet Sci 1987; 42: 294-298.
4. Krawinkel DJ. External ear canal. In Slatter(ed): Textbook of small animal surgery. 2nd ed Philadelphia, WB Saunders Co. 1993: 1560-1567.
5. Sperull JSA. Treatment of otitis media in the dog. J Small Anim Prac 1964; 5: 107-152.
6. Lane JG, Little CJL. Surgery of the canine external auditory meatus: a review of failures. J Small Anim Prac 1986; 27: 247-254.
7. Smeak DD. Total ear canal ablation. Bojrab MJ (ed): Current Techniques in Small Animal Surgery. 3rd ed. Philadephia, Lea & Febiger. 1990: 142-147.
8. Denny HR. The results of surgical treatment of otitis media and interna in the dog. J Small Anim Prac 1973; 14: 585-600.
9. Trower ND, Gregory SP, Renfrew H, Lamb CR. Evaluation of the canine tympanic membrane by positive contrast ear canalography. Vet Rec 1998; 142: 78-81.
10. Grono LR. The external ear canal. In Slatter(ed): Textbook of small animal surgery. 1st ed Philadelphia, WB Saunders Co. 1985: 1906-1914.