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PROTOCOL FOR DIAGNOSIS, TREATMENT AND SUBSEQUENT CARE OF PRIMARY SECRETORY OTITIS MEDIA IN CAVALIER KING CHARLES SPANIELS

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ABSTRACT

Primary Secretory Otitis Media in the Cavalier King Charles Spaniel is a rare and complex disorder. However, using a well established protocol, including well established procedures, modern day imaging technology, precise treatment and adequate post-treatment care can lead to a high rate of successfully dissipated symptoms and long-term well-being our the patients. The suggested protocol is based on 14 examined patients in a 1 year time period. It includes otoscopic examination, cytology, culture and sensitivity testing, magnetic resonance imaging, viodeootoscopy, deep ear cleaning, myringotomy, educating the owners, owners' feedback, subsequent therapy and long-term follow up. The study concludes that MRI and educating the owners are two extremely important tools that should not be overlooked. Additionally, further research with the addition of DNA analysis is needed.

Key words: Primary secretory otitis media (PSOM), Videootoscopy, Myringotomy, Magnetic resonance imaging (MRI), Cavalier King Charles Spaniel.

Introduction

The purpose of this work is to introduce the reader with a successful protocol to diagnose and treat PSOM in Cavalier King Charles Spaniels.

PSOM in Cavalier King Charles Spaniels is a syndrome with unknown origin when mucous material is accumulated in the middle ear (Bolder, N., 2015; Burrows, M., 2008; Hayes GM, Friend EJ, Jeffery ND, 2010). Thick, soft palate and reduced cross-sectional area of the nasopharynx are two predisposing factors for auditory tube dysfunction. The broad spectrum of clinical signs presented include: head and neck pain, tilting of the head, drooping ear or lip, reduced ability to climb/walk down stairs and to jump, head scratching/rubbing, reduced activity, "fly biting," otitis externa, otic pruritus without otitis externa, spontaneous vocalization, horizontal neck carriage, neurological signs (ataxia, facial paralysis, nystagmus, head tilt or seizures). All of those can lead to suggest PSOM, syringomyelia and/or Chiari-like malformation (Bolder , N., 2015; Burrows, M., 2008; Cole LK, 2010; Cole LK 2017).

Unfortunately, dogs of the Cavalier King Charles Spaniel breed in many cases have more than one disorder simultaneously. PSOM often remains undiagnosed or misdiagnosed. After a traditional otoscopy an assumption regarding the diagnosis can be made, but only MRI can give a definite diagnosis. Myringotomy and a middle ear flush can remove the accumulated mucous material. Moreover, in combination with an appropriate supporting therapy this can lead to all symptoms dissipating.

Materials and methods

Animals

Included in this study were 14 Cavalier King Charles Spaniel dogs (n=14), aged between 1 and 6 years, that have presented in Multidisciplinary Veterinary Clinic Bulgaria between January 2021 and December 2021 with symptoms corresponding to PSOM. All medical procedures were performed in accordance to animal welfare laws and regulations and with the written permission of the owners.

Otoscopy

Otoscopy is a visual examination of the ear canal and the eardrum with an otoscope. The otoscope used in this study was a Heine beta vet Otoscope set 2.5 V. The aim was to examine the vertical and horizontal canal and the tympanic membrane (TM). Canine TM is composed of pars flaccida and pars tensa. The pars flaccida gets swollen when there is an increased pressure in the middle ear. In such a case, it is not always clearly and easily visible. The pars tensa is mainly visible when the TM is examined during otoscopy. All dogs in this study have undergone otoscopy examination (Cole LK, 2010; Cole LK, Samii VF, Wagner SO et al., 2015).

Ear Cytology

In case the otoscopy examination revealed clinically significant abnormalities, samples from the ear canal were taken to undergo cytology. The cytology was obtained from the junction between the vertical and horizontal aspects of each external ear canal (EEC). Cytology of ear canal was performed with a non-sterile swab on all dogs in this study.

For cytology Diff Quick type staining with Hemacolor Rapid kit, 111674001 (Merck) and Microscope Euromex Bio Blue (Netherland) were used. The cytology samples were examinated in 10 oil-immersion fields.

Culture and Sensitivity Testing

Culture and sensitivity testing was performed with a sterile swab (Transwab, China) on 2/14 dogs that exhibited necessity for further investigation.

The samples for culture and sensitivity testing were conducted in a reference laboratory – Independent Medical Diagnostic Laboratory "Kandilarov", accredited by ISO 9001:2008, using the diffusion method. (Cole LK, Kwochka KW, Kowalski JJ et al., 1998; Cole, LK, Rajala-Schultz, P. J., Lorch, G., Daniels, J. B., 2019; Matsuda, H., Tojo, M.Fukui, K.Imori, 1984; Tater KC, Scott DW, Miller WH et al., 2003).

MRI

MRI is a crucial part of PSOM diagnosis. It was performed on all dogs in this study. The MRI machine used was an Easaote vet – MR (Easaote, Italy). Brain and whole spine transverse and sagittal images in T2- and T1-weighted were performed. Patients were under general anesthesia with positive ventilation (Veterinary Ventilator RWD R 409 Plus, China).

Videootoscopy

Videootoscopy is a method comparable to standard otoscopy, but it uses a high-powered, fiber-optic camera, enabling in-depth visualization of the vertical and horizontal ear canals and the eardrum. The patient must be under general anesthesia with Isofluran, intubated with a secure endotracheal tube with a well inflated balloon in order to prevent fluid aspiration from auditory (Eustachian)

tube drainage. (Bolder , N.,2015; Burrows, M., 2008; Cole, LK , Nuttall T., 2021; Nuttall T, Bensignor E., 2014; Stern-Bertholtz W, Sjöström L, Håkanson NW, 2003)

The otoscope was attached to a port that enabled thorough flushing and suction of the ear canal, facilitating the removal of wax, mucous, debris and other foreign matter. In this study for videootoscopy a Karl Storz Veterinary otoscope 67260 OSA set with diameter 5 mm, lengh 8,5 cm, GmbH and Co. KG, Tuttlingen, Germany with working channel diameter 5 mm and stopcock attachment with integrated working channel and LUER- Lock adaptor for irrigation was used. Videootoscopy in this study was performed on 8 out of 14 dogs. Pictures and video were captured and shared with the owners.

Deep ear cleaning

During videootoscopy a deep ear cleaning was performed. Deep ear cleaning is a very important step before myringotomy. The goal is to achieve a maximumly clean canal through numerous flushings, aspiration and mechanical cleaning. This way the eardrum can be visualized as best as possible. A saline bag (0.9%Naci, Braun, Germany) was attached to the work channel of the videootoscope. For aspiration a Vetpump Storz, Outer tube with Luer Lock adaptor 67479 S or 5 F urethral catheter attached to the Vetpump was used. I performed numerous suctions and irrigations with saline. With ear curret (Karl Storz 76261 K, small, 5 F,length 30) I made fast reduction of the cerrumen and debris. In some cases it was necessary to use a Karl Storz Grasping Forceps, 5Fr, length 34 cm for fast reduction of big ceruminolytes. When strong waxy debris or drier wax accumulation was observed I used solution Otoprof (ICF, Italy) which had a strong ceruminulitic effect, finishing off with saline flushing. (Cole LK, 2010; Nuttall T, Cole LK, 2004; Nuttall T, Bensignor E., 2014; Stern-Bertholtz W, Sjöström L, Håkanson NW., 2003)

Myringotomy

The final step of the videootoscopy procedure is the myringotomy followed by a middle ear (ME) flushing. The myringotomy was performed by passing a myringotomy needle (Karl Storz 67071 XS) and making an incision in the caudoventral quadrant of the pars tensa. The needle was advanced until the tip hit the bone. Simultaneously, aspiration was carried out.

In each case a long sequence of rinsing the middle ear with a warm solution of 0.9% sodium chloride was carried out. Those flushings were executed using the myringotomy needle or a 5F urethral catheter (Kruuse, China) attached to a 20 ml syringe filled with saline. The goal was to completely remove any mucous from the middle ear. The mucous material often could not be effectively suctioned from the middle ear, because it was too viscous and jelly-like. Therefore, I always finished off by flushing the ME cavity with a mucolytic solution Tris – NAC (ICF, Italy; solution with TRIS_ EDTA BUFFER + N- Acetylcysteine) and depositing dexamethasone 2 % (Alfasan, Netherlands). The damage to the TM in the pars tensa got completely restored after 3-4 weeks. During myringotomy samples of the mucous material were taken for cytology and/or culture and sensitivity testing. (Cole, LK, 2021; Cole LK, Samii VF, Wagner SO et al., 2015; Marino J, Loughini CA, 2012; Owen MC, Lamb CR, Lu D et al., 2004; Reinbacher E, Kneissl S, Hirt R et al., 2020; Stern-Bertholtz W, Sjöström L, Håkanson NW., 2003)

Subsequent therapy

Every dog in this study was prescribed: (1) ex temp. ear drops with Dexamethasone 1% (1:1 with 0,9 % NaCl: Dexamethasone 2%) 0,3 ml/12h for 2 weeks, followed by 0,3 ml/24h for 1 week, followed by three applications of 0,3ml every other day, finishing with a pulse therapy 1 time

weekly; (2) N-acetylcysteine 600 mg/dog/12h per os (N-Acetyl Cysteine, Haya Labs, USA) for four weeks; (3) Prednisolone (Dermipred 10 mg, Ceva, France) 1 mg/kg/24h for 5 days, then 50% this dose for 5 days, then 25% of this dose for 5 days. At this point a control check-up was performed. After culture and sensitivity testing results came back, therapy was adjusted if needed. Receiving feedback from the owner during this post-treatment period was extremely important (Cole LK, 2017; Stern-Bertholtz W, Sjöström L, Håkanson NW, 2003).

Results

8/14 dogs displayed abnormalities in the TM. Out of those 7 dogs had large and easily visible bulging of the pars flaccida and 1 had flat pars flaccida (in this 1 dog after MRI PSOM was confirmed).

6/14 dogs displayed erythema of EEC; waxy and dark-brown ear discharge; with MT not easily visible. OTIS 3 score for left/right ear was as following: 6/4, 4/3, 4/2, 2/4, 0/4, 0/3.

2/14 dogs displayed erythema of EEC, erosion, oedema and exudate. OTIS 3 score for left/right ear was a following: 8/6, 8/8.

6/14 dogs displayed discrete changes of erythema and/or oedema of the EEC. OTIS 3 score for left/right ear was as following: 1/1, 0/1, 2/0, 2/1, 2/0, 2/2.

In 8/14 cytology samples were negative for inflammatory cells, bacteria and yeast; in 4/ 14 only single Malassezia pachydermatis (less that 5/ oil-immersion field – OFI) were detected; in 2/14 large number of cocci (more than 10/ OFI), a large number of Mallassezia pachydermatis, plus single inflammatory cells and DNA strands were detected. Accordingly, culture and sensitivity testing was performed in those last 2 /14 cases. Staphylococcus pseudintermedius was detected in both and it was sensitive to Gentamicin.

Cytology Results

	occurance	**finding**
group 1	8/14 (57.14%)	negative for inflammatory cells, bacteria and yeast
group 2	4/14 (28.57%)	single Malassezia pachydermatis
group 3	2/14 (14.29%)	large number of cocci, large number of Mallassezia pachydermatis, single inflammatory cells and DNA strands

Culture and Sensitivity Testing Results

	occurance	**finding**	**medication of choice**
group 3	2/2 (100%)	Staphylococcus pseudintermedius	Gentamicin

During MRI examination the operator was seeking the presence of soft tissue opacity in the ME. 8/14 dogs presented an MRI image that was characteristic of PSOM (Figure 1), with hypo- to isointense material on T1W and hyperintense material on T2W in the Tympanic bulla. Presence of uniform hyperintense material within one tympanic bullae was observed in 3/8 dogs and in both tympanic bulla in 5/8 dogs. Additionally, 3/14 demonstrated MRI image suggesting only PSOM, 1/14 dogs demonstrated MRI image suggesting only Syringomyelia (Figure 3) and 3/14 dogs demonstrated MRI image suggesting only Chiari-like malformation. 0/14 displayed both PSOM and

Syringomyelia, 0/14 displayed both PSOM and Chiari-like malformation and 2/14 displayed both Syringomyelia and Chiari-like malformation (Figure 2). 5/14 cases displayed simultaneously PSOM, Syringomyelia and Chiari-like malformation.

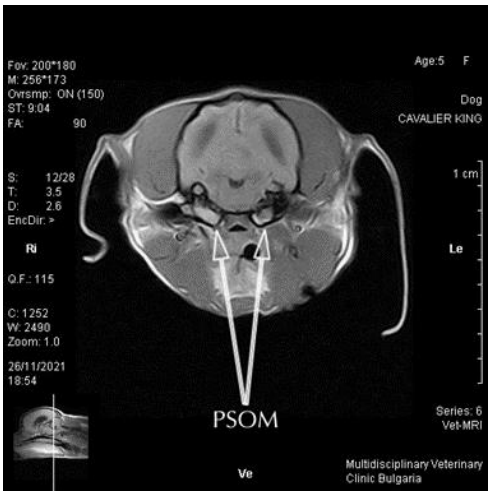

Figure 1: MRI presentation of PSOM (uniform hyperintense material within tympanic bulla).

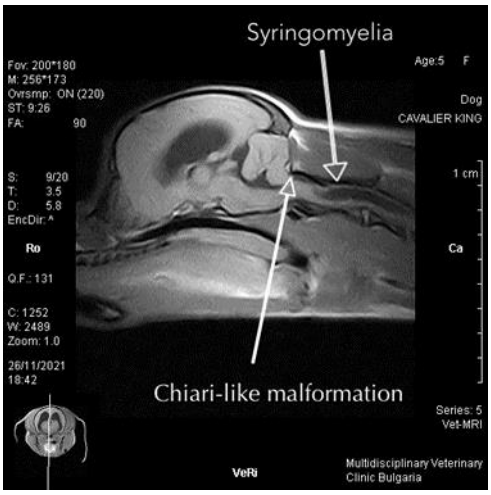

Figure 2: MRI presentation of Chiari-like malformation (mismatch of the structures of the caudal cranial fossa causing the cerebellum to herniate into the foramen magnum) and Syringomyelia (fluid filled cavities in the spinal cord).

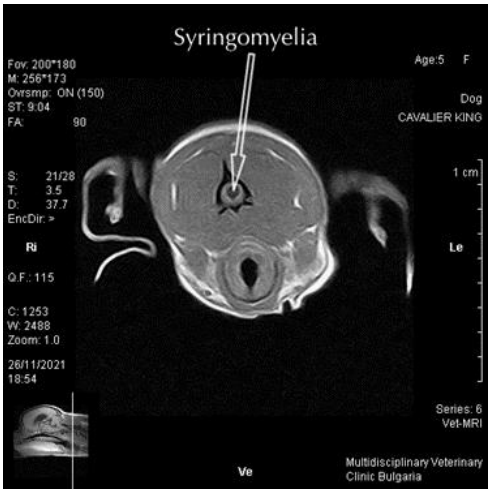

Figure 3: MRI presentation of Syringomyelia (fluid filled cavities in the spinal cord).

Videootoscopy, Deep ear cleaning, Myringotomy and ME Flushing was performed on those 8 patients that presented with PSOM suggesting MRI. Owners were informed that it is not possible that PSOM resolves on it own and the Myringotomy procedure under Videootoscopy control is necessary (McGuinness SJ, Friend EJ, Knowler SP, et al., 2013). In 3/8 dogs the myringotomy was bilateral and in 5/8 dogs was unilateral. This was a total of 11 myringotomy procedures that were

performed in the study. In 5/8 dogs myringotomy and ME flushing was performed as planned, resulting in the successful evacuation of the mucous substance from the MEC. In 3/8 dogs the pars tensa was not well visible and it was not easily accessible for myringotomy, because of the enlarged pars flaccida. In these cases I had to slip the myringothomy needle under the pars flaccida in the caudoventral quadrant of the pars tensa in order to make the myringothomy.

All dogs were followed up after the procedure. After the first week and after the second week, phone calls were conducted with the owners, who reported that the dogs were well and therapy was taken as prescribed. Control exam was performed in the clinic after the third week. The goal was to evaluate the patient clinically and to examine the recovery of damage to the TM in the pars tensa. 8/11 TM after myringothomy were completely recovered and 3/11 TM were not completely recovered at the time of that check-up.

For the first group (8/11) oral Prednisolone was canceled and patients continued only on N-acetylcysteine per os for 1 week and on ear drops with Dexametasone three applications of 0.3ml every other day, finishing with a pulse therapy 1 time weekly for 4 weeks. For the second group (3/11) oral Prednisolone, the ear drops with Dexametosone and N-acetylcysteine per os were continued for 10 days. After 10 days a recheck of the TM was performed. In all 3 cases a recovery of the TM was observed and patients were put on ear drops with Dexametasone three applications of 0.3ml every other day, finishing with a pulse therapy 1 time weekly for 4 weeks. All owners were informed that after myringotomy unfortunately, a recurrence of PSOM is possible. That would be accompanied by the return of some of the clinical signs: head and neck pain, tilting of the head, drooping ear or lip, head scratching/rubbing, reduced activity, "fly biting," otitis externa, otic pruritus without otitis externa, spontaneous vocalization, horizontal neck carriage, neurological signs (ataxia, facial paralysis, nystagmus, head tilt or seizures), reduced ability to climb/walk down stairs and to jump and severe bulging pars flaccida obscuring the pars tensa visible in otoscopy. It is not completely clear when and why PSOM returns. Two clinical studies mention the following: Recurrence of PSOM is common, with one study reporting almost 20% of dogs having relapses of clinical PSOM 6-18 months after their first procedure (Brooke, S.). After a single myringotomy procedure the mean recurrence time is 19.9 months with a median of 13 months and a recurrence rate of 61% (Bolder , N., 2015).

Discussion

During otoscopy examination we used clinical score for canine otitis externa OTIS 3: erythema, oedema, erosion/ulceration, and quantity of exudate (Nuttall T, Bensignor E., 2014). This scoring systems allows for an accurate and objective evaluation of the ear canal and to compare condition at the control check-up.

Otoscopy is an important and indicative method, which is also readily available, but in case of pain, large amounts of ear wax and/or a patient who does not tolerate examination, the PSOM cannot be easily and definitively excluded or confirmed solely by otoscopy. Moreover, the absence of a bulging pars flacida is not indicative of absence of PSOM. Therefore, additional diagnostic methods are highly recommended and the veterinary professional should never relay only on otoscopy. (Cole LK., 2010; Cole LK., 2017; Cole LK, Kwochka KW, Kowalski JJ et al., 1998; Nuttall T, Bensignor E., 2014)

On two patients culture and sensitivity testing was performed and according to the results they had to be prescribed preparatory therapy for two weeks: (1) extempore prepared ear drops with

Gentamicin and Dexamethasone (1mg/ml Gentamicin and 2 mg/ml Dexamethasone) – 0.3 ml/12h/ in the EEC; (2) Ear cleaning with Otodine (ICF, Italy) / 2 times per day. A control examination and culture testing was performed post therapy. It was negative for both patients and they were entered for the next procedures of the study. This leads to suggest that PSOM is a sterile process that is not infectious related. Most probably it is associated to increased production of mucous or the reduced drainage of mucous from the ME cavity. Moreover, this is indicative that the contamination rate of the ME during myringotomy in this study was zero. (Cole LK., 2017; Cole LK, Kwochka KW, Kowalski JJ et al., 1998; Cole, LK, Rajala-Schultz, P. J., Lorch, G., Daniels, J. B., 2019; Matsuda, H., Tojo, M.Fukui, K.Imori, 1984; Tater KC, Scott DW, Miller WH et al., 2003)

MRI results lead to the conclusion that there exists a strong relationship between the Chiari-like malformation and PSOM and Syringomyelia, the former most possibly being a predisposing factor for the development of the other two in many cases. Also, it is extremely common that patients get diagnosed with all three malformations. Therefore, in my opinion it is important that further studies regarding this matter are conducted in the future that use MRI but also take into consideration a genetic factor by incorporating DNA sequencing and mapping.

An important note regarding MRI that need to be pointed out is the presence of a microchip. Pedigree dog usually get microchipped at an early age. However, a microchip in the neck area is often a hindrance for MRI as it strongly reduces the quality of the imaging. Therefore, it needs to be removed. Perhaps, the Cavalier King Spaniel breed clubs need to establish different procedures in regards to the location of the microchip.

Through the use of modern technology like MRI it was possible to clearly differentiate between these three different pathologies since they were presenting with similar clinical signs. Therefore, MRI is a crucial method to be used in accurately diagnosing not only PSOM, but also Syringomyelia and Chiaria-like malformation.

After myringotomy mucous matter came out under one of the following forms: (1) a cloud of smoke that was being sucked out through the endoscopic catheter (Figure 4), 6/8 dogs, or (2) a jelly-like substance that popped out (Figure 5), 2/8 dogs. During every myringothomy samples were taken. 11/11 samples were cyctologically examined and were negative for inflammatory cells, bacteria and yeast. 11/11 samples were also negative for culture and sensitivity testing. Due to these results, subsequent therapy proceeded in the standard manner described above, without the inclusion of antibacterial agents.

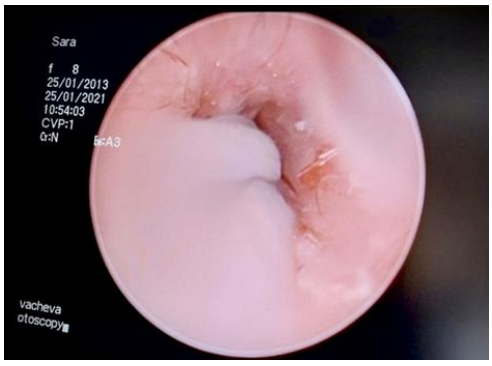

Figure 4: Mucous matter evacuating like a cloud.

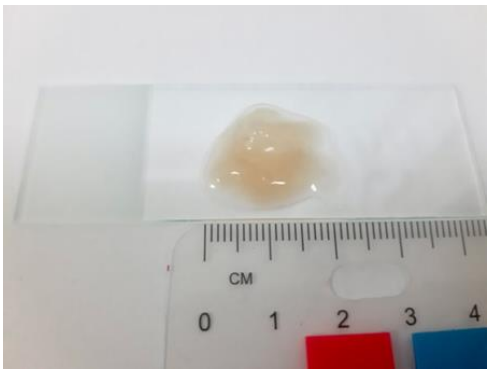

Figure 5: Mucous matter in the form of a of smoke after myringotomy jelly-like substance after myringotomy.

During times of global pandemic, we veterinary doctors have become accustomed to not being able to schedule check-ups for our patients as often as we would like to. Therefore, training the owners and raising their knowledge and abilities regarding their pets' disease has become a crucial and valuable tool. Owners got instructed on how to properly observe for the above-mentioned symptoms that are typical for PSOM, Syrgingomyelia and Chiari-like malformation and if necessary a check-up was scheduled. At the moment of writing this study, between 3 and 14 months have passed after performing myringotomy. During that time period, 3 dogs experienced complaints related to erythema of the auricula and scratching around the eyes and chin. At that exam these patients had an OTIS 3 score of 1/1, 1/2 and 1/2 accordingly. The otoscopic examination revealed mild erythema of the external auditory canal, without any secretion and with a clearly visible tympanic membrane without any abnomalities in the pars flaccida and pars tensa. All these sympoms corresponded to a seasonal allergy and were not connected to PSOM. Therefore, in my study none of the patients had experienced recurrence of PSOM. Those patients will continue to be followed up and if necessary MRI diagnostics will be performed again in order to evaluate the current progression of the disease.

Conclusion and recommendations

To summarise, my protocol for diagnosis, treatment and subsequent care is a following:

1. Complete exam including otoscopy
2. Ear Cytology and Culture and sensitivity testing
3. MRI
4. Videootoscopy
5. Deep Ear Cleaning
6. Myringotomy
7. Subsequent care including therapy, control examinations and owner education

Studies like this are extremely important because they raise awareness regarding a rare and complicated disease in the general public, veterinary medical professionals, Cavalier King Charles owners and breeders. The latter being of great importance in order to try establish recommendations for testing animals before putting them into a breeding program. This will benefit the breed by reducing the animals presenting with PSOM and the cases of the disease being passed on to the offspring.

There is a wast abundance of different types of ear related diseases. Good knowledge of the symptoms, use of various diagnostic methods, use of modern imaging technology should all be used in synergy in order to be able to accurately diagnose and treat each individual case.

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