pISSN 1598-298X / eISSN 2384-0749
J Vet Clin 35(5) : 184-189 (2018)
http://dx.doi.org/10.17555/jvc.2018.10.35.5.184

Journal of Veterinary Clinics
www.ksvc.or.kr

Selection of Appropriate Endotracheal Tube in Wild Birds

Jin-Ho Jang*,*, Young-Seok Park**, Hee-Jong Kim**, Hye Kwon Kim*** and Young-Min Yun*[1]**

**College of Veterinary Medicine and Veterinary Medical Research Institute, Jeju National University, Jeju 63243, Korea*
***Chungnam Wild Animal Rescue Center, Kongju National University, Yesan 32439, Korea*
****Infectious Disease Research Center, Korea Research Institute of Bioscience and Biotechnology, Daejeon 34141, Korea*

(Received: August 09, 2018 / Accepted: October 12, 2018)

Abstract : Wild birds rescued for various reasons are injured and admitted to a wild animal rescue center. With the case of collision with cars, buildings and wires on a power pole, most wild birds are severely traumatized or get fractured, which need intensive veterinary treatment. In general, inhalation anesthesia to wild birds is the best choice for the medical and surgical procedure, and intubation is recommended for the stable anesthesia. Although the certain size of an endotracheal tube can be chosen depending on the size and morphology of the bird, there are a few standardized guidelines. Therefore, the optimal endotracheal size of the rescued 162 individual birds of 41 species for four years from March 2014 to December 2017 was investigated and sorted empirically, suggesting possibly the appropriate endotracheal sizes for diverse avian species. It may provide practical information data for wildlife veterinarians to select the size of an endotracheal tube according to the size of the domestic wild bird species, especially during surgery in the emergency cases.

***Key words* :** anesthesia, an endotracheal tube, selection, size, wild birds.

Introduction

Wild birds rescued for various reasons admitted to a wild animal rescue center. After simple physical restraint depending on the conditions of the individual, the essential treatments, such as physical examinations, radiography, and blood sampling for blood tests are begun for rescued birds. However, in the case of emergency treatment or fractures with severe trauma, a chemical restraint is made to reduce the damage of soft tissues such as muscles and skin, and to minimize the stress. Although a wild bird can be in a state of chemical restraint using either injection anesthesia or respiratory anesthesia, later one reacts more sensitively and rapidly under anesthesia due to the unique anatomical and physiological characteristics of avian species, unlike mammals (1,3). In case of birds, the level of optimum dose on injection anesthesia are various due to the subsequent physiological effect depending on the species and anesthetics, which may make it very difficult to control the capacity of the appropriate dose (1,2,7). It also is hard effectively to reduce the time between anesthesia induction and recovery under injection anesthesia (3,7). Therefore, the respiratory anesthesia using inhalation anesthetics is generally preferred because the depth of anesthesia can be controlled by adjusting the concentration of inhaled anesthetic medication (1,3,5).

For the inhalation anesthesia, selection of the optimal endotracheal tube is important. Generally, in the case of a companion animal, suitable ET tube sizes for the species and their weight are well-established based on the experience of various clinical cases. However, there is no sufficient data about wild. As a result, it is difficult to select a suitable ET tube in wild birds, especially in the emergency situation. Therefore, in this study, Authors investigated optimal sizes of the ET tubes from the 162 rescued wild birds of 41 avian species which had been intubated for inhalation anesthesia and oxygen supply in Chungnam Wild Animal Rescue Center between March, 2014 and December, 2017. To provide practical information data for wild life veterinarians to select the optimal size of the ET tubes, the appropriate sizes of the ET tube according to species and body weights were analyzed.

Material and Method

Inhalation anesthesia was performed when the rescued birds were in need of restraint or surgery. Firstly, induction of the anesthesia was carried out using Isoflurane (Ifran®; Hana Pharm) with a self-made mask specified for the avian species after checking the health condition. The body temperature was maintained using a warm mat, and a premedication was not used during the induction. Briefly, anesthesia was induced with 5% isoflurane and maintained with 2-3% isoflurane in 100% oxygen 2 L/minute. Anesthesia induction was generally possible within 5 minutes, and after induction, meloxicam (Metacam; Boehringer Ingelheim) was injected for analgesic and antiphlogistic action.

Under the induction of anesthesia, the injured bird's right lateral and ventrodorsal radiography were taken, and tracheal internal diameters on radiography were measured using length measurement instrument with iView program (CAD impact, inc.; Seoul, Korea) to select the appropriate ET tube

[1]Corresponding author.
E-mail : dvmyun@jejunu.ac.kr

size. The measuring parts were three points of trachea around the end of ET tube. Among the estimated tracheal internal diameters, the minimum value was selected and the closest size of ET tube (COVIDIEN; Mansfield, USA) was determined. The selected ET tube was intubated without cuff using lubricating jelly (K-Y JELLY; Midrand, South Africa) to the end part of ET tube. After intubating, bird's respiration state was checked, and the ET tube was fixed with lower mandible using 3M tape (3M; Anseong, Korea). Heartbeat was monitored with Audio patient monitor (A.M.Bicford Inc.; Newyork, USA), while checked body temperature with digital thermometer. During anesthesia, the respiration state was checked, and careful observation was carried out. After all procedures are finished under anesthesia, as a recuperating step, waste anesthetic gas in circuits was taken away. Sufficient oxygen was also supplied in order to awake the birds from the anesthesia. After overall steps, possible problems such as irregular breathing and breathing sound were checked. If the selected ET tube worked without any anesthetic problem, useful data about the successful ET tube size, species and weight of the intubated wild bird was documented. The average weight of each species according to the optimum diameter of the ET tube was calculated using Microsoft applications, particularly Microsoft Excel 2016 (Excel; Microsoft, USA).

Results

During surgery and emergency treatment nothing significant to matter, anaesthesia is maintained successfully with various diameter sizes of ET tube intubated in accordance with each species. Due to the fact that observation of that regular breathing gets back before releasing captive bird, the decision and affirmation that respiratory tract and mucosal membrane are no damage is made.

Collectively, the successful sizes of endotracheal tubes depending on weight measured on 162 intubated wild birds of 41 species were presented in Table 1. Based on the collective data, one or two sizes within 0.5 mm (ID) of ET tubes were selected for a specific species. However, Eurasian Buzzard (*Buteo buteo*) and Eurasian Eagle Owl (*Bubo bubo*) were needed three or four sizes of ET tubes, respectively, and correlation with the average weight seemed not to be evident. Small wild birds like Jungle Nightjar (*Caprimulgus indicus*) and Oriental Scops Owl (*Otus sunia*) should be intubated with either 16G or 14G intravenous (IV) catheters, IV Catheter is used in the absence of appropriate ET tube. while Feral Dove (*Columba livia*), Rufous Turtle Dove (*Streptopelia orientalis*) and Broad-Billed Roller (*Eurystomus orientalis*) needed 14G IV catheters or 2.0 mm (ID) size of ET tube.

Sizes of ET tube depending on species are different. But though it may be different species, the same size of ET tube could be used in conditions which approximated the measurement weight as closely as possible. Different size of ET tube is used depending on weight at especially same species, but the difference of object specified regardless of weight is verified.

Discussion

Wild birds have been rescued from various causes. The anesthetic condition is commonly needed for the medical treatment such as physical examination, radiography and surgery. In case of invasive or emergent surgery, inhalation anesthesia should be conducted after intubating of ET tube (2,7). In addition, unlike mammalian species, premedication with parasympatholytics and injectable anesthetic agents in avian species usually accompanies with side effects such as trachea obliteration due to hyper secretion and delayed recovery (1,4,6,7). Therefore, inhalation anesthesia with appropriate ET tube is essential for the wild bird treatment. As the diameter of the trachea in the most birds becomes narrow from glottis toward the syrinx of a bird (8), the ET tube can be selected as the smallest size among all measured tracheal internal diameters. However, in practice, the successful ET tubes might be slightly smaller or larger than the estimated ET tubes. If the selected ET tube was larger than that of the trachea, it can cause serious damage to the trachea. In case that the size of ET tube is smaller than that of trachea, the injured birds can breathe with difficulty due to incomplete anesthesia. Further, a slight gap between the glottis and the ET tube is recommended (2,6,7).

It is necessary to minimize the damage of the glottis during endotracheal intubation. In particular, in birds like a long beak and long neck Heron, belonging to the family Ardeidae and the order Ciconiiformes, it is so easier to observe the glottis at the base of the tongue if pulling its tongue with gauze or forceps during endotracheal intubation. The length of the beak, and the size and length of the trachea can be varied depending on bird species. So it is important to confirm the position of the glottis during endotracheal intubation.

A small sized bird with applying IV catheters should be carefully monitored for respiratory condition and the inside of the tube specially. In particular, in the case of a catheter because the inner diameter of the tube is too small, the catheter lining is occasionally clogged by respiratory secretion, and bending the tube may occur. Consequently an IV Catheter that can be replaced immediately must be prepared.

In addition, the size and length of the trachea can be varied depending on bird species. Therefore, in this study, the successful ET tube sizes in different species of wild birds would better guide veterinarians to select an appropriate ET tube for clinical application.

Although this paper focuses on the optimum size of ET tubes in diverse wild bird species, there are other points to be considered during intubation in avian species. Especially, the cuff in the ET tube should be removed or handled with extreme caution (2,4). Since the bird's trachea has complete circular cartilage unlike mammals, and the tracheal mucosa is extremely delicate, it can be infected or injured by the cuff. The damage of tracheal mucosa causes fibrosis, and subsequently the lumen of the trachea gets narrow, and consequently, dyspnea from complications shows up (1,2,3,8). Therefore, ET tube without cuff is recommended for above case like this type of birds (2,3,6,7,8).

Table 1. Successful endotracheal tube sizes of wild bird species based on mean weight and standard deviation

Order	Family	Species	No	Tube ID[a] size (mm)											
				16G[b]	14G	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
Anseriformes	Anatidae	Bean goose (*Anser fabalis*)	1						3,096						
		Mandarin Duck (*Aix galericulata*)	1					468							
		Spot-billed Duck (*Anas poecilorhyncha*)	4					789[c] (± 24)[d]	735 (± 46)						
		White-fronted Goose (*Anser albifrons*)	1							1,840					
Caprimulglforms	Caprimulgidae	Jungle nightjar (*Caprimulgus indicus*)	1		86										
Charadriiformes	Laridae	black-tailed Gll (*Larus crassirostris*)	7				384 (± 107)	399 (± 36)							
Ciconiiformes	Ardeidae	Cattle egret (*Bubulcus ibis*)	1			326									
		Great Egret (*Ardea alba*)	1						1,174						
		Green-Backed Heron (*Butorides striatus*)	2			157 (± 21)									
		Large egret (*Egretta alba*)	1						798						
		Little egret (*Egretta garzetta*)	1				380								
		Purple heron (*Ardea purpurea*)	1						704						
		Schrenck's Bittern (*Ixobrychus eurhythmus*)	2			89 (± 21)									
	Ciconiidae	Oriental White Stork (*Ciconia boyciana*)	1										4,160		
Columbiformes	Columbidae	Feral Dove (*Columba livia*)	4		206	256 (± 48)									
		Rufous Trtle Dove (*Streptopelia orientalis*)	10		132 (± 6)	230 (± 41)									
Coraciiformes	Coraciidae	Broad-billed Roller (*Eurystomus orientalis*)	4		138 (± 18)	126									

Table 1. (Continued) Successful endotracheal tube sizes of wild bird species based on mean weight and standard deviation

Order	Family	Species	No	Tube ID[a] size (mm)											
				16G[b]	14G	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
Cuculiformes	Cuculidae	Eurasian Cuckoo (*Cuculus canorus*)	1			58									
		Indian Cuckoo (*Cuculus micropterus*)	2			104 (± 19)									
Falconiformes	Accipitridae	Cinereous Vulture (Aegypius monachus)	9											7,793 (± 696)	8,120 (± 966)
		Eurasian Buzzard (*Buteo buteo*)	6			620	818 (± 156)	840							
		Japanese sparrow hawk (*Accipiter gularis*)	1			138									
		Northern Sparrow Hawk (*Accipiter nisus*)	5				638 (± 233)								
		Northern Goshawk (*Accipiter gentilis*)	6			259 (± 14)									
		White-tailed sea Eagle (*Haliaeetus albicila*)	4								3,870 (± 183)	3,377 (± 315)			
	Falconidae	Common Kestrel (*Falco tinnunculus*)	28			182 (± 29)									
		European Hobby (*Falco subbuteo*)	3			163 (± 7)									
		Peregrine Falcon (*Falco peregrinus*)	2					610	950						
Galliformes	Phasianidae	Japanese Quail (*Coturnux japonica*)	1			92									
		Ring-necked Pheasant (*Phasianus colchicus*)	1						960						
	Rallidae	Coot (*Fulica atra*)	1				452								
Gruiformes	Gruidae	Hooded Crane (*Grus Monacha*)	1									3,320			
Passeriformes	Corvidae	black-billed Magpie (*Pica pica*)	4			175 (± 11)									
		Eurasian Jay (*Garrulus glandarius*)	1			104									
		Jungle Crow (*Corvus macrorhynchos*)	1					426							

Table 1. (Continued) Successful endotracheal tube sizes of wild bird species based on mean weight and standard deviation

Order	Family	Species	No	Tube ID[a] size (mm)											
				16G[b]	14G	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
strigiformes	Strigidae	Oriental Scops Owl (*Otus sunia*)	8	66	75 (± 5)										
		Brown Hawk Owl (*Ninox scutulata*)	14			182 (± 21)									
		Collared Scops Owl (*Otus semitorques*)	3			194 (± 17)									
		Eurasian Eagle Owl (*Bubo bubo*)	14					1,744 (± 620)	2,299 (± 328)	1,636 (± 124)	1,522				
		Eurasian Tawny Owl (*Strix aluco*)	2			354	588								
		Long-eared Owl (*Asio otus*)	1			272									
Total		41	162												

Conclusion

In conclusion, we collected solid data concerning the optimum ET tube sizes for various wild bird species from 162 birds of 41 species for four years. As there has been a little information on the appropriate ET tube sizes for the diverse wild birds compared to the companion animals, successful ET tube sizes in various wild bird species may be helpful for the wildlife veterinarians to select the size of ET tube during surgery under emergency situations.

Reference

1. Coles BH. Essential of avian medicine and surgery, 3rd ed. London: Blackwell. 2007: 124-141.
2. Edling TM. Updates in anesthesia and monitoring. In: Clinical Avian Medicine, Vol 2. Palm beach: Spix publishing Inc. 2006: 748-760.
3. Gunkel C, Lafortune M. Current techniques in avian anesthesia. Sem Avian Exot Pet Med 2005; 14: 263-276.
4. Lawton MPC. Anaesthesia. In: Manual of Raptors, Pigeons and Waterfowl. Cheltenham: British Small Animal Veterinary Association. 1996: 79-88.
5. Lawton MPC. Anesthesia and analgesia. In: Avian Medicine, 3rd ed. Missouri: Elsevier. 2016: 179-191.
6. Muir W, Hubbell J. Handbook of Veterinary Anesthesia, 5th ed. St. Louis: Elsevier. 2013: 450-468.
7. Sinn LC. Anesthesiology. In: Avian Medicine: Principles and application. Lake worth: Wingers. 1994; 1067-1080.
8. Sykes JM, Neiffer D, Terrell S, Powell DM, Newton A. Review of 23 cases of postintubation tracheal obstructions in birds. J Zoo Wildl Med 2013; 44: 700-713.