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General Anesthesia In Wild Birds

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Abstract: Birds have unique anatomical and physiological characteristics that have significant impacts on anaesthesia. Understanding and knowing the distinctive feature of the cardiorespiratory system of birds is important in terms of the method of administering anaesthetics and selecting suitable anaesthetics. Endotracheal tubes used in birds must be uncuffed since the inflated cuff may cause necrosis as a result of pressure in the tracheal mucosa. Intubation is risky in small birds because endotracheal tubes with small internal diameters show significant resistance to airflow, especially if mucus accumulates in the tubing. Birds do not have epiglottis. The absence of epiglottis increases the aspiration leak sensitivity that is shaped before or right after the application of anaesthesia. In birds, injections made in the caudal area such as legs are eliminated by the renal-portal system before being engaged in the systemic circulation. Since the pectoral muscle mass is weak (minimal) in flightless birds, the hip muscles are preferred as the place of injection. In wild birds, similar to mammals, different anesthetic agents are commonly used.

Key Words: Anesthesia, Raptor, Wild life.

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1. INTRODUCTION

Birds have unique anatomical and physiological characteristics that have significant impacts on anaesthesia. Understanding and knowing the distinctive feature of the cardiorespiratory system of birds is important in terms of the method of administering anaesthetics and selecting suitable anaesthetics.

ANATOMY

The trachea of birds is 2.7 times longer and 1.3 times wider than the trachea of mammals (1). This also increases the dead space of the respiratory system (approximately 4 times), however, the fact that the air flow rate in the trachea is four times slower when compared to mammals is compensated by the fact that the rate of gas exchange in lungs is four times higher (2). The trachea in birds consists of complete cartilaginous closed rings, and the trachea mucosa has a delicate structure (m. trachealis is not present). Therefore, endotracheal tubes must be uncuffed since the inflated cuff may cause necrosis as a result of pressure in the tracheal mucosa, a tear may occur in tracheal rings, and this may cause the formation of fibrous tissues in the tracheal mucosa that causes bleeding after the operation and narrowing of the tracheal lumen. These complications may not emerge until 3-7 days after intubation (1).

Intubation is risky in small birds because endotracheal tubes with small internal diameters

show significant resistance to airflow, especially if mucus accumulates in the tubing. The mucosal membrane of a bird's trachea produces mucus when the patient is under anaesthesia, and this mucus becomes dense and sticky with the drying effect of the cold and dry gases inhaled. Endotracheal tube obstructions may be determined by observing shapes in the ventilation of birds. The duration of expiration extends as the airways become blocked. While the air sacs exhibit a relatively normal attitude during inspiration, it confirms the presence of an obstruction in the airways in birds that breath mechanically deeply since it will either become discharged slowly or will not discharge at all during expiration. The patient must be observed closely, and the mucus that is present should be removed regularly (3).

Birds do not have epiglottis. The absence of epiglottis increases the aspiration leak sensitivity that is shaped before or right after the application of anaesthesia. Therefore, the use of endotracheal tubes is advised in most of birds that are taken under general anaesthesia (4) (Figure 1).

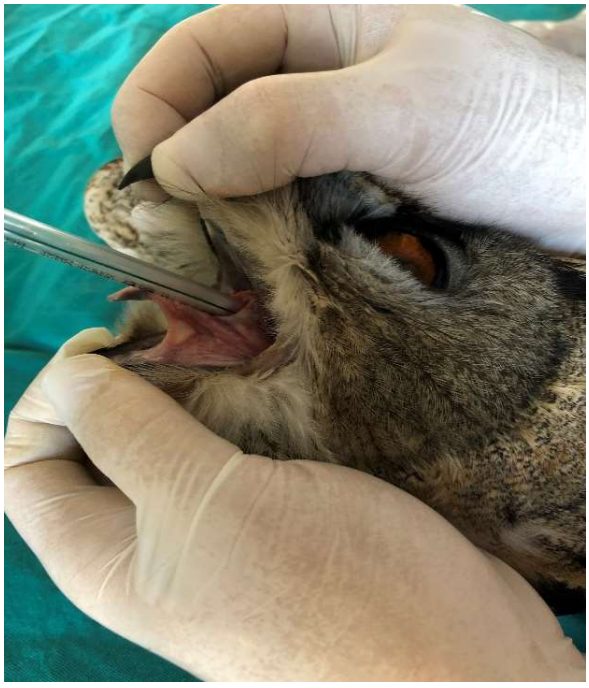

Figure 1: Usege of endotracheal tube.

Since the lungs of birds are connected to their thoracic wall, the dimension of their lungs does not increase significantly. Instead, the air sacs that are not engaged in the gas exchange perform the pushing function by blowing the air through the lungs (4). Gas exchange occurs in lungs both during inspiration and expiration, as distinct from mammals (2). Birds do not have the diaphragm; the inspiration and expiration cycle depends on the muscular activity. The respiratory cycle primarily helps breathing with the upward and downward movement of the sternum using intercostal and pectoral muscles. While the inflation of the sternum requires a strong muscle activity during inspiration, its release during expiration occurs without showing much effort (4). This need for exercising must be taken into consideration when a surgical intervention procedure is applied to a sick bird since birds are frequently positioned in the dorsal recumbent position. The body positions of birds in anaesthesia significantly affect ventilation. The weights of abdominal organs apply pressure to the abdominal air sacs in the dorsal recumbent position, and the active volume of the air sacs decreases, therefore ventilation also decreases (3). Birds must be taken to the ventral or lateral lying position as much as possible right after the application of a surgical operation (4).

Most birds have 9 air sacs (4 pairs, 1 single). The air sacs that store the air inhaled are avascular and they do not contribute to gas exchange, but they contribute significantly to the respiration cycle (1). The air sacs form a diverticulum inside certain bones (pneumatic bones such as humerus, femur, cervical vertebrae, sternum, ribs, pelvis, pectoral girdle) that make up the bird skeleton in order to decrease the weight (2).

INJECTION SITES

There is a renal-portal system in the caudal area in birds, and this system ensures the transition of the blood to kidneys before reaching the heart. In birds, injections made in the caudal area such as

legs are eliminated by the renal-portal system before being engaged in the systemic circulation (2). An intramuscular injection is performed from pectoral muscles in most of birds. Since the pectoral muscle mass is weak (minimal) in flightless birds, the hip muscles are preferred as the place of injection. Subcutaneous injections are not recommended since the absorption of anaesthetics becomes weaker; however, in case a subcutaneous injection is preferred, its place is either between the scapulae or the inguinal area. The areas for injection are the right jugular vein (since it is bigger than the left jugular vein), brachial vein (it is at the level of the elbow joint, in the ventral angle of the wing) (Figure 2), or metatarsal medial vein (especially in water birds and avian predators). As a rule, the amount of the blood taken from a bird should not exceed 1% of the body weight. This amount generally does not cause any side effect in a healthy animal; however, care must be taken in anaemic, hypovolemic or dehydrated animals. In this case, it is more suitable to take blood in an amount that is equal to 0.5% of the body weight of a bird, as a maximum (1). An intraosseous injection provides benefit when the intravenous application is difficult in hypotensive or very small birds. Intraosseous injections are performed from the proximal of the ulna or the cranial of the tibiotarsus (since they are linked to the femur and humerus air sacs) (Figure 3). The absorption of the drug is similar to the intravenous injection (3).

Figure 2: Injection site: brachial vein.

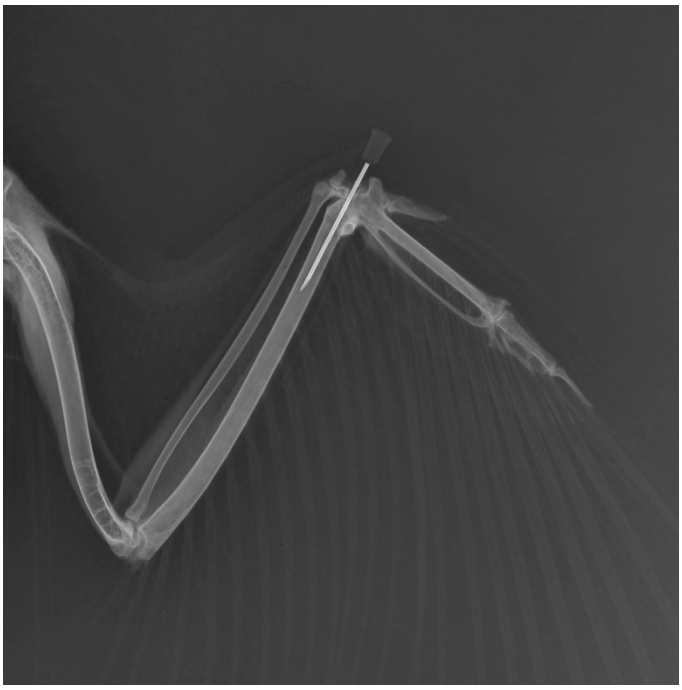

Figure 3: Intraosseous perfusion (radiographic image)

ANESTHETIC AGENTS

An ideal avian anaesthetic agent should create minimum stress in the application, generate quick induction and ensure a return, trigger physiological changes at a minimum level, provide sufficient safety for the required procedure, and it should be used safely in critical situations. In a avian patient,

contraindications for anaesthesia are severe obesity, fatty liver, liver and kidney failure, dehydration, shock, anaemia, dyspnea, and the liquid in the product (5).

Anticholinergics such as atropine or glycopyrrolate reduce mucus production and the plug shape of the mucus, but it may increase the mucus viscosity, which is harder to clean. The fact that tracheobronchial secretion and salivation become viscous may cause obstructions in the airways (1).

Furthermore, some bird general practitioners avoid using anticholinergics in birds because anticholinergic drugs increase the heart rate, which increases the oxygen need of the myocardium and the functioning of the heart. The negative cardiac effects of anticholinergics may outweigh their benefits (3).

It was found out that the use of the anaesthetic combination that contains medetomidine, midazolam and ketamine is not safe in ducks since it shapes bradycardia (3) (Table 1).

Table 1. Preanesthetic Agents (mg/kg) (8).

Animal Species / Anesthetics	Eagle	Parrot	Anseriformes	Wild Duck	Pigeon	Hawk	Owl	Falcon	Seagull
Acepromazine	2.2					2	2		
XylazineHCl	1 - 3	1 – 10			10	2.2		2	1
Diazepam	1	0.5 - 4	0.5 - 1		0.5 - 2.5	1 – 1.5			0.2 - 1
Medetomidine HCl	0.05 – 0.35	0.05 – 0.15	0.05 – 0.85	0.44	0.08 – 0.2	0.06 – 0.08			
Butorphanol Tartrate	2 - 4	1 - 4			4				
Atropine	0.02 - 0.5	0.5			0.27				
Glycopyrrolate					0.01				

5 or 10 mg/kg doses of Telazol (Tiletamine and Zolazepam) are a safe and effective anaesthetic in horned and small owls although it causes a decrease in the heart and respiration rate. Telazol (in catching avian predators) in the same dose has an undesirable effect in red-tailed hawks/falcons since it increases the heart and respiration rate and causes an increase in salivation (3).

Ketamine hydrochloride has an insufficient analgesic effect during surgical procedures. It may also cause too much excitement during awakening in birds since it does not ensure relaxation in muscles. Therefore, ketamine should not be used as an anaesthetic agent alone, and it should be used together with alpha 2 agonist or benzodiazepine drugs (4) (Table 2).

Table 2. Anesthetic Agents (mg/kg) (8).

Animal Species / Anesthetics	Eagle	Parrot	Anseriformes	Wild Duck	Pigeon	Hawk	Owl	Falcon	Swan	Seagull
Chloral Hydrate					106.5		106.5	64-68		106.5
Propofol		1.33	8	10	4.1-14				6-10	
Tiletamine +Zolazepam	10-20	2.64-25.2	2.7-8.8	5-35	30-60		10		6.6	
Ketamine HCl	2-35	2.5-20	5-50	8.8-20	5-20	4-40	10	30	4-12.5	

The main risk of inhalation anaesthetics especially in small birds is hypothermia as a result of the wide surface areas of air sacs. Therefore, the pre-heating of anaesthetic gases, the use of gas humidifiers and the use of an external heat source may significantly reduce body temperature losses (4).

Isoflurane and sevoflurane are the most widely used inhalation anaesthetics in the anaesthesia of birds. These anaesthetics cause less cardiovascular depression when compared to halothane and methoxyflurane and dissolve less, and biotransformation is shaped at a minimum level (6,7).

Inhalation anaesthetic agents have many advantages when compared to injectable anaesthetics. These are the titre effect, having a more consistent therapeutic index, fast induction, and providing smooth and quick feedback. In addition to this, the anaesthetic part can be protected for different durations, and its effect can be reversed immediately as it is determined with procedures that are especially established using isoflurane (5) (Table 3).

Table 3. Inhalation Anesthetic Agents (8)

Anesthetics / Animal Species	**Halothane**	**Isoflurane**
Parrot		1.44
Duck	1.05	1.32
Crane		1.35

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