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Original Article

Morphological and histopathological study of Air Sacs (Sacci pneumatic) in Japanese Quail (Coturnix coturnix japonica)

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ABSTRACT

This study aimed to investigate the anatomical and histological features of air sacs in Japanese quail. Twenty healthy birds from Japanese quail (10 Males and 10 Females) were obtained for routine anatomical and histological study, 2 ml of 10% chloral hydrate was injected directly into the heart and then they were injected via trachea with a cold cure plastic mixture for corrosion cast making. The birds were immersions in 3% potassium hydroxide 40c for maceration, washing by tap water. Grossly, the quail had eight air sacs , four of these were paired, cranial thoracic, caudal thoracic, and abdominal air sacs, While the singular air sacs were the interclavicular and cervical. Histological investigation confirmed that the wall of air sack composed of a delicate single layer of squamous or cuboidal epithelial cells supported by a delicate layer of connective tissue.

Key words: air sac, maceration, epithelium, corrosion cast.

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Introduction

The avian respiratory system characteristics by the presence of air sacs that connects with lungs, most of the birds possessed nine air sacs pair of cranial thoracic, caudal thoracic, abdominal and cervical air sacs with a single clavicular air sac.(Powell,2000:Dunker,2004) The cervical and clavicular air sacs in mallard ducks consistent with previous studies, the cranial thoracic air sacs was smaller than the caudal sacs pneumatics the second to seven ribs

by their diverticula, the caudal thoracic air sac had no diverticulum, the left abdominal air sac had two parts, the cranial and caudal sacs (Demirkan et.al. 2006). The number of the air sacs in duck and goose is nine, four paired sacs with one unpaired the clavicular sack (Brown et. al. 1985: Joines et. al. 1985, While Milson et. al. 1992 explain that the number of the air sacs, Canada's geese are eleven, four paired and three single, the clavicular, dorsal and sacral air sac. There are seven air sacs in turkey, whereas the pair caudal thoracic air sacs absence and connects the air sacs with the secondary bronchus (Cover, 1953).

Getty, 1975 mention that the air sacs of the avian connect into lungs directly by primary bronchus. The wall of the air sack was thin and lines by simple squamous epithelium supported by collagen and elastic connective tissue (Hodges, 1974) The epithelium lining of simple squamous or cuboidal epithelium such as in Penguin (Duncker, 1974) or squamous in avian, duck and goose. This study was designed to investigate the anatomical and histological features of air sacs in Japanese quail.

MATERIALS AND METHODS

This study was approved by the research committee / College of Veterinary Medicine, University of Basrah, / Iraq. The present study carried out on twenty quails (10 males and 10 Females) obtained from the Basrah local market, for anatomical study, the corrosion cast method used in ten birds injected via trachea by a cold cure plastic mixture after euthanasia by 10% chloral hydrate injected directly into the heart. They were macerated with 3% potassium hydroxide at 40^0C for 48 hours (Caja et. al, 1999), then they washed with tap water, each sac was colored by different oil tincture. Ten birds obtained for histological study, the samples immediately post-fixed in 10% neutral formalin. The specimens were washed in running water, dehydrated in a graded series of alcohol, cleared in xylol and embedded in paraffin wax, serial sections of five micrometers thick were made, mounted on slides and stained with hematoxylin and eosin (Luna, 1968).

RESULTS AND DISCUSSION

The air sacs in Quials illustrated by a corrosion cast method using cold cure plastic material, showed that quail had eight sacs, three paired and two unpaired, the paired were caudal, cranial and abdominal air sacs, while the single sacs were cervical and interclavicular air sacks (Fig;1) The results of this study is in agreement with (Duncker 2004,Getty1975,King and Mclleland 1984,Powell 2000). Our results are also compatible with (Cevik et.al,2006), who reported that the air sac related to Japanese quail were the cervical,the clavicular ,the cranial ,the caudal and the abdominal sacs . However our results are in disagreement with (Milson et.al.1992) who study the air sac in goose and found that it possessed eleven air sacs.

The interclavicular sac receiving air via the tertiary bronchi, the cranial thoracic air sack had three indirect connecting groups with tertiary bronchi while there were direct connections of the caudal thoracic air sac with the first and second lateral secondary bronchi, while the abdominal air sac connects directly with the primary bronchi.

This study revealed the following features:

1. The cervical and interclavicular sacs;
Cervical sac situated on the cranial part of the thoracic cavity under the cranial cervical and cranial region of vertebral column, they bounded ventro-laterally the

clavicular bone,choroid bone and the anterior thoracic wall, the ribs and sternum (Fig 2).
2. The interclavicular sac aerated from the third abdominal secondary bronchi, the retrocardiac diverticula were observed at the caudal end of the interclavicular sac. The bronchial divercula occupying on the posterior end of the sternum, while the auxiliary diverticula (diverticulum axillare) lies around the shoulder joint (Fig; 3). This result is in agreement with (Duncker 1971) and (Mennega and Galhoun 1968) that showed similar results in chick and chine's ducks respectively.
3. Caudal and cranial thoracic sacs; The cranial thoracic sacs was opposing the thoracic wall between the second and fifth rib beneath the pulmonary hilus. They presence three surfaces: costocervical surface, pulmonary surface and ventromedial surface. The caudal thoracic sacs lie between the cranial thoracic and abdominal sacs, they aerated by the first and second lateral secondary bronchi on the middle of the lateral border of the lung medial to the fifth rib (Fig 4). And this result is compatible with Cevik et.al.(2006) ,powell (1983) and Kurtul et.al.(2004) ,While, it is incompatible with Hadeel (2003)and Khadim (1996) in duck and goose.
4. Abdominalsacs:
The abdominal sacs occupying on the abdominal cavity , its extended caudal to the lungs beneath the posterior part of the abdominal cavity, theses sacs regard as the largest and covered the kidneys and adrenal gland .The wall sac fused dorsally with the kidneys to the floor of mesentery and became free to step down into the abdominal cavity (Fig: 5). The right abdominal sac was longer than the left one (Fig: 6). And this result is in agreement with Maina (1989) and Abdullah (1989).
The histological observations revealed that the wall of the air sacs composed of a thin layer of squamous or cuboidal epithelium supported by a very thin bundle of connective tissue involves a bundle of collagen and elastic fibers, The average of air sac wall thickness was 0.028 micrometers (Fig;). This results are in agreement with King(1970),Duncker (1971) , Hodges (1974) in chicks, and in disagreement with Cook et.al.(1986) who found that the air sac wall had ciliated epithelial layers.

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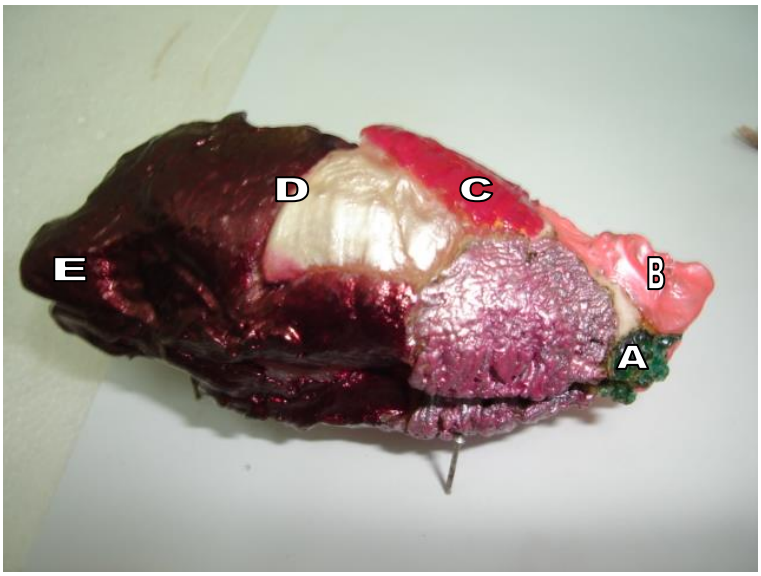

Fig .1.Corrosion cast of air sacs of Quial. A- cervical air sac . , B- interclavicular air sac , C- anterior thoracic air sac .D- posterior thoracic a. sac ,E- abdominal thoracic air sac .

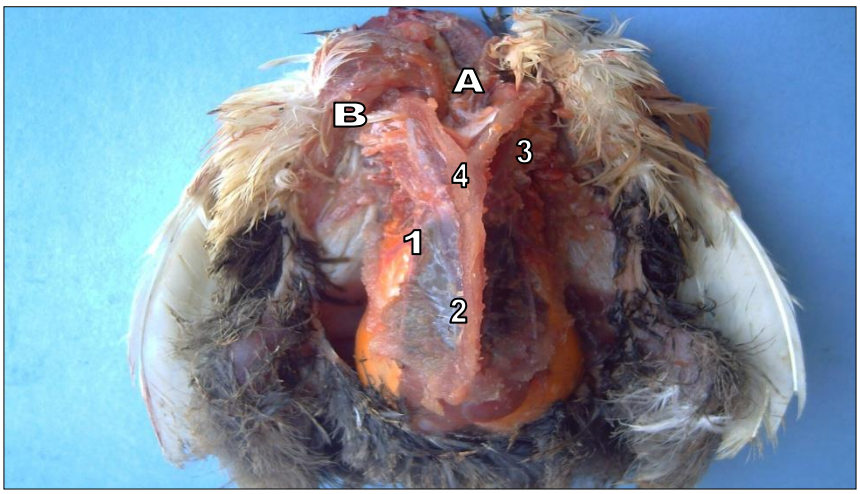

Fig (2);Ventral and lateral borders of the cervical and interclavicular air sacs
1)Ribs . 2) Sternum 3) Clavicula . 4) Hart .A) cervical air sac . B) interclavicular air sac .

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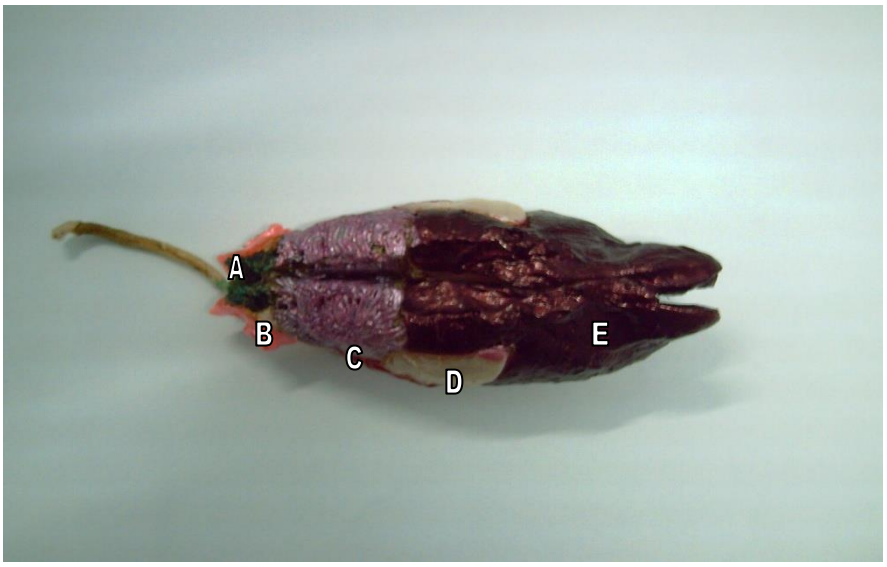

Fig (3);corrosion cold cure cast for the air sacs (dorsal view) A- cervical air sac . B- interclavicular air sac . C- anterior thoracic air sac. D- posterior thoracic sac .E- abdominal thoracic air sac .

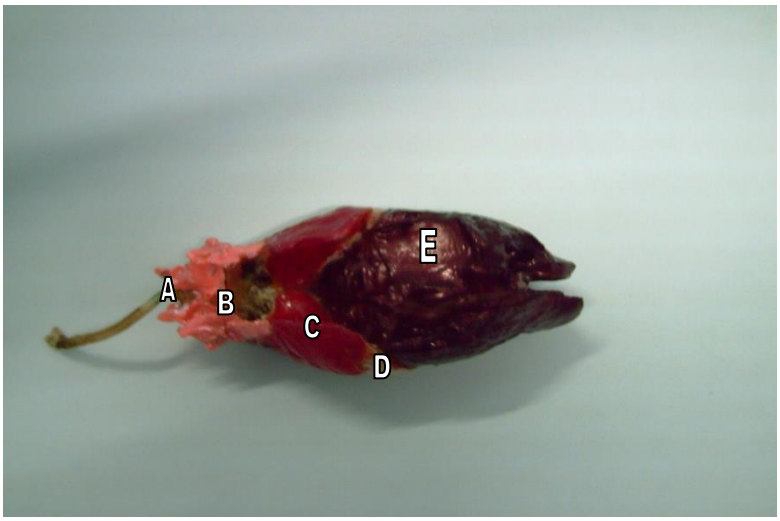

Fig (4); Cold cure corrosion cast (ventral view) A-cervical air sac. B-interclavicular air sac C-anterior thoracic air sac . D- posterior thoracic. sac .E-abdominal thoracic air sac .

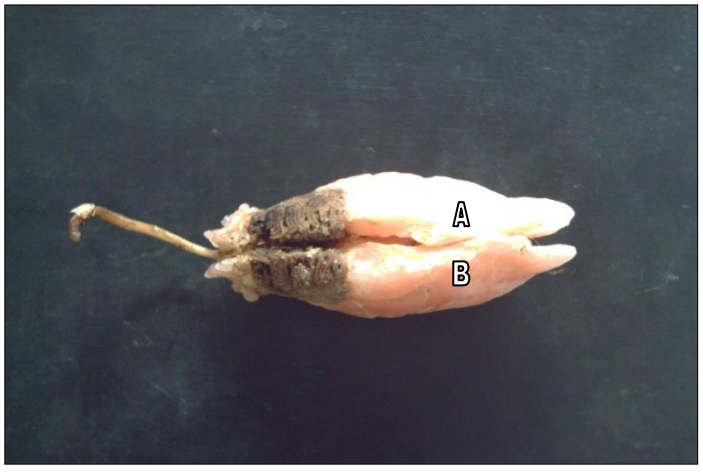

Fig (5) Corrosion cast of air sacs show; A-femoral diverticulus of the abdominal air sac
B-Suprarenal diverticulus of the abdominal air sac

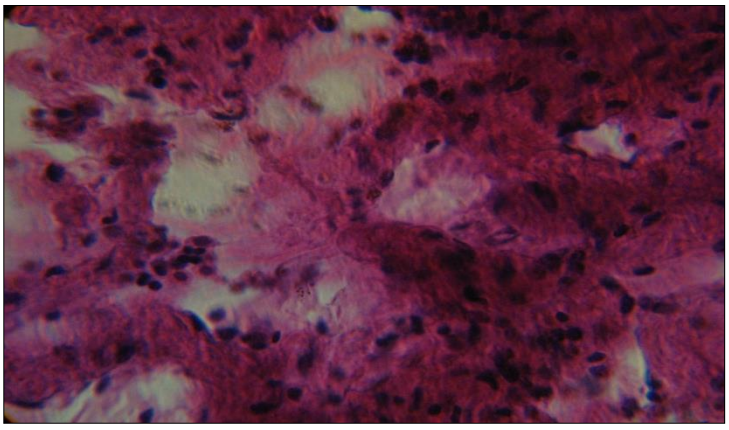

Fig (6);Squamous epithelial cells of the wall of air sac .X1000,H&E

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