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Gross morphological studies on the bursa of fabricius in Japanese quail (*Coturnix coturnix Japonica*)

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Abstract

The present study was undertaken to explain the gross morphology and morphometry of bursa of Fabricius in Japanese quail. Bursa were collected from day-old to eight months of age of both the sexes. The bursa of Fabricius was located attached to the dorsal wall of the proctodeum and its shape and colour varied at different age groups. The maximum weight, length, width and number of plicae in the lumen of the bursa increased gradually and reached maximum at 5 weeks of age in both sexes.

Keywords: Bursa of fabricius, Japanese quail, gross anatomy, involution

1. Introduction

The bursa of Fabricius is a lymphoid organ which is unique for the avian species that is of immunological importance. It is a temporary lympho epithelial organ of birds which is well developed at hatching and involutes completely after sexual maturity in most species [1]. Bursa of Fabricius provides the microenvironment for the development, maturation and differentiation of B lymphocytes and antibody diversification, aiding in humoral immune response in avian species [2]. The Japanese quail is comparatively resistant to many of the avian diseases which differentiates it from other domesticated avian species. The present study is proposed to provide the detailed information on postnatal gross anatomical changes and involution of bursa of Fabricius in Japanese quail. The study also paves the way to understand the differences in gross anatomy of bursa in Japanese quail from other avian species.

2. Materials and Methods

The bursa of Fabricius samples were collected from day-old to sixth week of age at weekly interval, afterwards collected at second, third, sixth and eighth month of age. Each age group consisted of six birds of either sex. The body weight and sex of the birds were recorded. The birds were sacrificed by decapitation and the bursa was approached through ventral abdominal dissection and located dorsal to the cloaca [3]. The organs were exposed to study the topography. Shape, colour, weight, length, width of the bursa and number of plicae were observed and recorded. The observations were statistically analyzed using SPSS 16.0 and the mean of various parameters of different age groups were compared.

3. Results and Discussion

3.1 Topography: The bursa of Fabricius in Japanese quail is a blind sac like structure, connected to the dorsal wall of the proctodeum of cloaca by a small stalk in both the sexes of all age groups (Fig. 1) in accordance with observations recorded in turkey [4], Khaki Campbell duck [5] and guinea fowl [6].

3.2 Shape: The shape of the bursa of Fabricius in Japanese quail was cylindrical to elongate and it was independent of sex and age of the birds (Fig. 2) as observed in White Pekin ducks [7].

3.3 Colour: The colour of the bursa of Fabricius varied between pale pink, pink, gray and black which was not influenced by sex and age of the birds (Fig. 2). The observations were agreeing with results reported in guinea fowl [1]. Variations in the blood supply to bursa, physiological status of the bird, presence of digesta in the colorectum might be a reason for the colour differences.

3.4 Bursal weight: The weight of bursa of Fabricius increased gradually and maximum was attained at 5th week of age (215.27 ± 4.61 mg) in both sexes (Table I) as reported in ducklings [8] and in Khaki Campbell ducks [5]. After 5 weeks of age, the bursal weight decreased gradually up to 6 months of age in both sexes. In contrary, the maximum weight of bursa was reached at 9 weeks of age (2.07 ± 0.48 g) in White Pekin duck [7] and 6 months of age (3.1 g) in turkey [4]. These changes might be due to species differences and nutritional status of the bird.

3.5 Morphometry: The length and width of the bursa in Japanese quail gradually increased from day-old and reached maximum at 5th week of age (14.81 ± 1.31 mm x 6.65 ± 0.31 mm). Thereafter, the size of the bursa decreased gradually due to involution and disappeared completely at 8 months of age in both the sexes (Table I). Whereas, the maximum diameter of bursa was recorded at 7 to 9 weeks (6.45 mm) in White Pekin duck [7], six months of age (20.0 mm in females and 15.45 mm in males) in turkey [4] and four months of age (11.20 mm in females and 9.90 mm in males) in guinea fowl [6]. Species variation and age at sexual maturity may be a reason to variations in the previously reported morphometrical values of bursa.

3.6 Bursal index: In Japanese quail, the maximum relative weight of bursa (Bursal index) (Table I) was reached at the age of 5th week (0.0944 ± 0.004). In contrast to the observed values, the maximum bursa to body weight ratio reached at 6 months (1.15 ± 0.007 in males and 1.02 ± 0.006 in females) in turkey [9] and at day-old age (0.11 ± 0.12 mm in males and 0.13 ± 0.03 mm in females) in guinea fowl [6]. These differences in the bursal index might be due to variation in species, nutritional status and body weight gain of the birds.

3.7 Plica: The lumen of the bursa of Fabricius was occluded by number of mucosal folds or plicae (Fig.2) and the number varied in different age of the birds as noted in White Pekin duck [10] and Khaki Campbell duck [5]. The number of plicae in young adult quail was recorded as 5 to 9 [11]. The observation was contrary in guinea fowl [1], in goose [12] and in keets [13] as the authors had recorded varying numbers of plicae in the bursa in each species and they did not mention the age related differences.

In both the sexes, the number of plicae increased gradually from day-old and reached maximum at 5th week of age (9.1 ± 0.560), later the number gradually decreased because of the involutory changes.



Fig 1: Topography of the bursa of Fabricius in 5 weeks old male Japanese quail, B - Bursa of Fabricius, CL – Cloaca.



Fig 2: Colour, shape and size of bursa of Fabricius in Japanese quail at different age groups. Inset - Lumen of the bursa in 3 weeks old female quail showing plicae.

Table 1: Mean (\pm S.E.) values of morphometrical parameters of bursa of Fabricius in Japanese quail at different age groups

| Age | Body Weight (g) | Bursa Weight (g) | No. of Plicae | Length (mm) | Width (mm) | Relative weight (%) |
|-----------------------|--------------------|-------------------|----------------|------------------|-----------------|---------------------|
| Day old | 8.62 ± 0.15 | 3.59 ± 0.21 | 2.1 ± 0.28 | 2.93 ± 0.19 | 1.63 ± 0.08 | 0.0418 ± 0.003 |
| 1 st week | 17.21 ± 1.62 | 6.68 ± 0.53 | 2.6 ± 0.21 | 4.32 ± 0.20 | 2.06 ± 0.05 | 0.0402 ± 0.004 |
| 2 nd week | 38.08 ± 2.27 | 15.46 ± 0.59 | 3.8 ± 0.32 | 5.73 ± 0.29 | 2.26 ± 0.09 | 0.0416 ± 0.004 |
| 3 rd week | 111.29 ± 4.13 | 51.35 ± 2.61 | 6.5 ± 0.89 | 8.87 ± 0.19 | 3.49 ± 0.12 | 0.0466 ± 0.003 |
| 4 th week | 179.42 ± 5.73 | 119.57 ± 6.28 | 8.2 ± 0.56 | 13.05 ± 1.46 | 4.93 ± 0.29 | 0.0669 ± 0.004 |
| 5 th week | 229.91 ± 9.48 | 215.27 ± 4.61 | 9.1 ± 0.56 | 14.81 ± 1.31 | 6.65 ± 0.31 | 0.0944 ± 0.004 |
| 6 th week | 296.38 ± 8.11 | 140.91 ± 9.33 | 5.5 ± 0.47 | 14.69 ± 0.92 | 5.48 ± 0.42 | 0.0479 ± 0.004 |
| 2 nd month | 299.24 ± 15.76 | 109.63 ± 8.67 | 5.0 ± 0.36 | 10.52 ± 0.29 | 4.14 ± 0.19 | 0.0366 ± 0.002 |
| 3 rd month | 313.60 ± 3.59 | 75.08 ± 5.25 | 3.0 ± 0.40 | 10.44 ± 0.41 | 4.09 ± 0.56 | 0.0240 ± 0.002 |
| 6 th month | 323.45 ± 1.75 | 41.13 ± 3.15 | 2.3 ± 0.25 | 5.69 ± 0.41 | 3.24 ± 0.27 | 0.0127 ± 0.001 |

4. Conclusion

The bursa of Fabricius in Japanese quail was a blind sac like structure, situated dorsal to the cloaca, which was cylindrical to elongate in shape and varied from pale pink, pink, gray and black colour throughout the study period. The maximum bursal weight, length, width, bursal index and number of

plicae gradually increased from day-old to 5 weeks age and there after all the parameters reduced due to the onset of involution in the bursa of Fabricius.

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