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Morphological studies on Meckel's diverticulum in the duck (*Ansa ansa domesticus*)

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Summary

This research was carried out to define the morphological features of Meckel's diverticulum (MD) in duck and to investigate whether the MD resides in a constant position along the intestinal tract. For this purpose, a total of 30 adult healthy ducks of both sexes, 50-52 weeks of age were used. After dissecting, some morphological factors such as: total intestine length as well as the lengths of the intestine from the gizzard to MD (GMD), from gizzard to cloaca (GC) and from MD to the caecal opening (MDC) were measured. The weight, thickness and length of MD were then recorded. By using t-test and analysing factors between two sexes we concluded that, the location of MD in total specimens was 91.52 ± 8.09 cm far away from the gizzard. There was no significant difference between morphological factors of MD (weight, thickness and length) in both sexes ($P>0.05$). There was significant difference ($P<0.05$) between GMD, GC in both sexes. In histological studies of MD, aggregated lymphatic follicles and thin muscularis mucosa were observed in tunica mucosa.

Key words: Morphological study, Meckel's diverticulum, Duck

Introduction

The jejunum of the duck is arranged in several U-shaped loops at the edge of the dorsal mesentery, which forms a cone shaped mass with outer centripetal and inner centrifugal turns (Dyce *et al*., 1996). Usually between the loop of the duodenum and the longest jejunal loop there are three small loops which vary in size. The longest loop with Meckel's diverticulum (MD) is opposite to the distal parts of the cranial mesenteric artery and the corresponding vein and is the axial loop (Getty, 1975). In the developing chick embryo, the yolk duct is the peduncle that attaches the yolk sac to the intestine. In the post-hatching period, significant amounts of yolk may pass through the yolk duct into the intestine. The yolk duct and sac continue to grow after hatching and persist throughout the life of both sexes of the domestic fowl as an appendage of the small intestine (Getty, 1975; Nickel *et al*., 1977). It is known as diverticulum caecum vitelli (Nickel *et al*., 1977) or vitelline diverticulum and is referred to as MD.

Some researchers studied the blood flow measurements (Gush *et al*., 1990; Van Golde *et al*., 1990; Hu *et al*., 1996) and developmental changes in the yolk sac circulation of the avian embryo (Hogers *et al*., 1995; Plasswilm *et al*., 1996; Honda and Yoshizato, 1997).

Therefore, the exact morphological knowledge of MD is necessary for future studies and for proper diagnosis of pathological disorders such as polycystic immature teratoma and persistent MD. In the literature, few studies have been found on its morphology in birds. Considering this, we aimed to describe the various histological and morphological aspects of MD in the duck.

Materials and Methods

Thirty adult healthy domestic ducks of both sexes (15 males, 15 females) were used for this study. They were native breed in Shahrekord, 50-52 weeks of age and weighed between 1.4 and 1.6 kg. They were anesthetized and subsequently killed by exsanguination from the abdominal aorta

without regaining consciousness following the opening of the abdominal cavity with a median incision. The entire intestinal tract was removed and straightened.Various intestinal length from gizzard to MD (GMD), from MD to caecal opening (MDC) and from the gizzard to cloaca (GC) were measured. Length, thickness and weight of MD and total intestinal tract were also measured. The results were analysed and compared with t-test. For histological examinations, the tissue samples from MD and junction of it to jejunum were fixed in 10% buffered formalin, dehydrated, cleared and embedded in paraffin blocks and cut in 5 micron thick section. Sections of MD and jejunum were stained with Haematoxylin and Eosin (H&E) and the histological differences between them were studied under light microscope, respectively.

Results

MD was located at the apex of the axial loop of jejunum in duck. It was a bean-shaped structure in most specimens and vermiform in some of them and opened into the lumen of jejunum on papilla. The location of MD in total specimens was 91.52 ± 8.09 cm far away from gizzard (Table 1). It's mean weight in male was 43 ± 10.59 mg and in female 46 ± 10.75 mg. There was no significant difference ($P>0.05$) between morpho-logical factors of MD (weight, thickness and length) in both sexes (Table 1). By comparing between two sexes, in female the intestinal length was longer than that of the male and the location of MD was determined at 97.00 ± 6.96 cm from the gizzard. There was significant difference between GMD and GC in both sexes ($P<0.05$) (Table 1). In histological studies, MD was composed of a large amount of aggregated lymphoid follicles within the tunica mucosa. Comparing with jejunum, MD was lacking in villi and its muscularis mucosa was very thin and had only a circular layer. These results showed that MD differed from digestive system, particularly in its morphological structure and that it may play a functional role as a lymphoid organ.

Discussion

In this study we found that MD is always present as a well developed permanent structure in all ducks as reported earlier (Nickel *et al*., 1977). Moreover, it may be regarded as a useful boundary point because of the fact that its location was continuously constant in both sexes. In broiler chickens, position of MD is constant along the length of intestinal tract. This constancy of position supports the use of MD as a boundary point of the intestines (Branton *et al*., 1988).

The lymphoid development and structure of MD were studied. The lymphoid accumulation began at about 2 weeks of age and MD produced a large number of plasma cells, which were comparable to those glands of Harder and the cloacal bursa as reported by other researchers (Olah *et al*., 1984). In conclusion, we suggest that MD may be a novel lymphoid organ in duck because of its high amount of lymphoid tissue. The morphometric and histological findings of this study may help avoid

Table 1: Statistical analysis of morphological factors of MD in total specimens and comparing them between male and female sexes

Factors	No.	Total Mean ± SD	Sex				
			Male		Female		P-value
			Mean	SD	Mean	SD	
Body weight (gr)	30	1452 ± 103.20	1425	120.76	1480	78.88	0.24
GMD (cm)	30	91.52 ± 8.09	86.05	4.81	97.00	6.96	0.001
MDC (cm)	30	61.84 ± 5.64	60.88	3.04	62.80	0.96	0.46
GC (cm)	30	161.72 ± 11.65	155	6.76	167	12.44	0.012
MD length (mm)	30	6.92 ± 0.89	7.22	0.98	6.62	0.27	0.13
MD diameter (mm)	30	2.51 ± 0.36	2.58	0.40	2.44	0.32	0.40
MD weight (mg)	30	44.50 ± 10.50	43	10.59	46	10.75	0.53

misdiagnosis of MD-related pathological disorders such as polycystic immature tratoma and persistent MD in fowls. We hope that this study will shed light on future studies on MD and that it may contribute considerably to the present anatomical knowledge of the concerned structure in this species.

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