



SHORT COMMUNICATION

Spontaneous Atherosclerosis in Free-Living Pigeons in Mosul Area, Iraq

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ARTICLE HISTORY

Received: October 14, 2010
Revised: November 11, 2010
Accepted: November 12, 2010

Key words:

Atherosclerosis
Free Living
Iraq
Mosul
Pigeons
Spontaneous

ABSTRACT

The purpose of this study was to investigate for the first time the prevalence and pathology of spontaneous atherosclerosis in free – living pigeons in Mosul, Iraq. A hundred apparently healthy, 1-1.5 year old both sex pigeons of local breed free – living used. Effects of factors such as weight, sex, age and health status on prevalence of the condition were also studied. Prevalence of naturally occurring atherosclerosis was 10%. Grossly, the heart was hypertrophied and of firm consistency, aorta and coronary arteries were prominent and cordlike with thickened walls. Microscopically, lipid – laden "foam cells" were seen throughout the thickened tunica media and intima. Damage of the elastic lamellae and hypertrophy of the smooth muscle cells were also noted. Spontaneous atherosclerosis occurred more frequently in old pigeons. No effect was found for sex, weight, and health status of the pigeons on prevalence and pathology of spontaneous atherosclerosis. It was concluded that spontaneous atherosclerosis is fairly common in local pigeons and it occurred more commonly in old pigeons. Sex, weight, and health status of the pigeons did not constitute risk factors for the occurrence of spontaneous atherosclerosis.

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To Cite This Article: Al-Sadi HI and AK Abdullah, 2011. Spontaneous atherosclerosis in free-living pigeons in Mosul Area, Iraq. *Pak Vet J*, 31(2): 166-168.

INTRODUCTION

Spontaneous atherosclerosis has been reported almost all in breeds of pigeons even though prevalence of the condition varies widely between breeds (Bavelaar and Beynen, 2004). In this avian species, a direct relationship was found between plasma cholesterol and atherosclerosis as induced by cholesterol feeding. Pigeons, quails and chickens have been widely used as experimental animals in atherosclerosis research (Bavelaar and Beynen, 2004). Lesions of spontaneous atherosclerosis in pigeons occur at the bifurcation of the thoracic aorta into the celiac axis and abdominal aorta. These lesions are grossly and microscopically similar to those seen in humans and occur at similar sites along the arterial tree (Kjaernes, 1981; Smith *et al.*, 2001). The purpose of this study was to investigate the prevalence and pathology of the naturally occurring atherosclerosis in free living pigeons in Mosul, Iraq.

MATERIALS AND METHODS

One hundred free living apparently healthy pigeons of both sex, aged less than one year to 1.5 year were used in this study. Ageing was done according to wing

plumage coloration and wear plus primary molt patterns. According to morphological and structural features of pigeons, were identified as rock dove type (*Columba livia*) (Altman *et al.*, 1997; Tully *et al.*, 2000). The pigeons were bought from the local markets of Mosul city through random visits to these markets. They were transferred immediately to the main laboratory of the Department of Pathology and Poultry Diseases, College of Veterinary Medicine, University of Mosul. The pigeons were examined externally for the presence of lesions and external parasites. The weight, sex, age and health status of each pigeon were recorded.

Birds were sacrificed for necropsy, the aorta was removed from the heart to the sciatic trifurcation, opened longitudinally along the dorsal side, and the celiac branch region was dissected free. Specimens were collected from the aorta (celiac bifurcation) and the coronary artery and fixed in 10% neutral formalin solution for 48- 72 hours. Following fixation, the specimens were washed under tap water, dehydrated in ascending grades of alcohol, cleared in xylol and embedded in paraffin wax (60 – 62°C melting point). Sections of 4-6µm thickness were cut and stained with hematoxylin and eosin (Kiernan, 2000). The stained sections were examined under microscope and photographs were taken using a digital camera.

RESULTS

Ten out of the 100 pigeons were positive for spontaneous atherosclerosis and thus the prevalence of the conditions was 10%. Grossly, the heart of affected pigeons was hypertrophied and of firm consistency. The aorta and the coronary arteries were prominent and cordlike with thickened walls (Figs. 1 and 2). Microscopically, lipid-laden "foam cells" were seen throughout the thickened tunica media and intima (Fig. 3). Damage of the elastic lamellae and hypertrophy of the smooth muscle cells were noted (Fig. 4). In some of the cases, there was heavy infiltration of mononuclear cells (particularly lymphocytes) in the perivascular spaces and close to the tunica adventitia. Atherosclerosis occurred more frequently in old (9 cases) than in young (one case) pigeons. No effect of gender, weight, and health status could be observed on the prevalence and pathology of spontaneous atherosclerosis in pigeons under study.

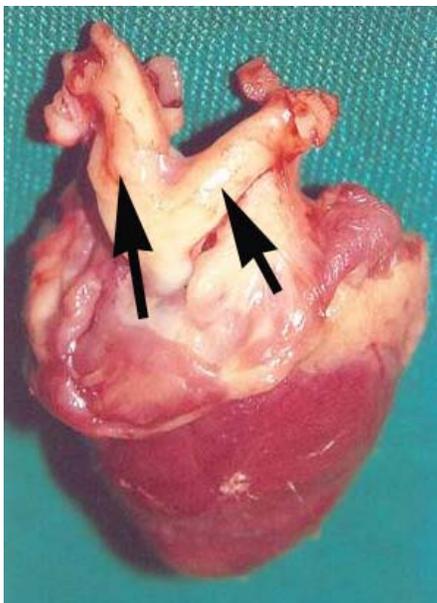


Fig. 1: The heart and major blood vessels of a pigeon affected with spontaneous atherosclerosis, Note the prominent and cordlike blood vessels (arrows).

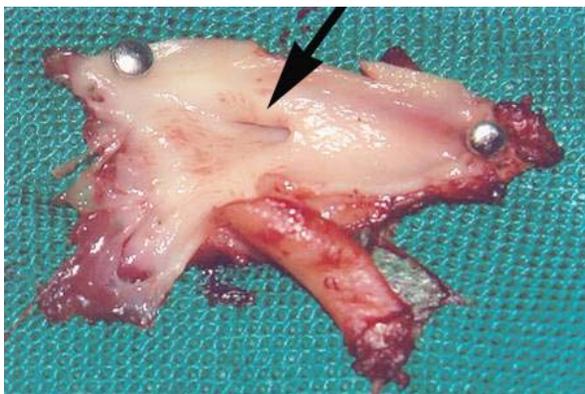


Fig. 2: An opened part of the aorta of a pigeon with spontaneous atherosclerosis. Note the whitish thickening of the wall (arrow).

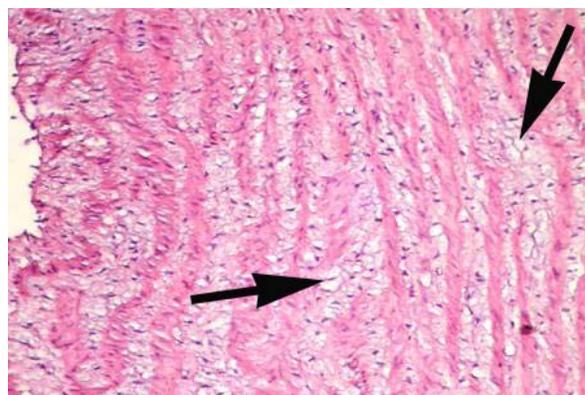


Fig. 3: Photomicrograph of the aorta of a pigeon with spontaneous arteriosclerosis. Numerous lipid vacuoles could be seen in the tunica media and the intima (arrows). H&E, 165X.



Fig. 4: Photomicrograph of the aorta of a pigeon with spontaneous arteriosclerosis. Damage of some of the elastic lamellae is visible (arrows). H&E, 165X.

DISCUSSION

In the present study the prevalence and pathology of naturally occurring atherosclerosis in free living pigeons has been described for the first time in Iraq. The prevalence of the condition was 10%. Smith *et al.* (2001) found a difference in the development of spontaneous atherosclerosis in White Carneau (WC) and Show Racer (SR) pigeons up to one year of age. Gross lesions of atherosclerosis appeared after 9-12 months in WC pigeons. An increase in the incidence was found from 30% at one year to 100% at 3-4 years (Prichard *et al.*, 1964). In WC pigeons it was found that at 4 years of age, 10% of the thoracic aorta surface in all birds was covered with plaques (Prichard, 1965). The incidence of coronary atherosclerosis was 70% in WC pigeons aged one through 12 years. The incidence of aortic atherosclerosis in SR pigeons was 15% after 7 years of age (Prichard *et al.*, 1964). It could be concluded that the prevalence of spontaneous atherosclerosis in pigeons varied according to breed and age of the pigeons.

In pigeon, quail and chicken, a direct relationship has been found between plasma cholesterol and atherosclerosis as induced by cholesterol feeding. Dietary polyunsaturated fatty acids versus saturated fatty acids lowered the plasma cholesterol concentrations in the three

avian species (Bavelaar and Beynen, 2004). In pigeons, the feeding of cholesterol has been found to enhance the rate of development, the severity and the extensiveness of atherosclerosis (St Clair, 1983). Susceptibility to spontaneous atherosclerosis in pigeons, assessed by the presence of grossly visible lesions at the celiac bifurcation of the aorta at 3 years of age, was inherited as autosomal recessive Mendelian trait. Studies using cell cultures indicated that the susceptibility is a constitutive property of aortic cells as indicated by vacuole formation and lipid contents in smooth muscle cells from various tissues in susceptible pigeons (Smith *et al.*, 2001). Thus, it could be stated that pigeons could be a good model to study the atherogenic factors leading to lesion development at the level of the arterial wall as well as the genetic influence on lesions development.

The pathological lesions reported in this study were similar to those reported in mammals and birds (Kumar *et al.*, 2003; Bavelaar and Beynen, 2004). Hansen (1977) conducted light and electron microscopic studies on the atherosclerotic lesions associated with celiac intimal smooth muscle cushions in four to five year old WC pigeons. It was found that the large intimal cushions composed of smooth muscle, abundant collagen, clusters of foam cells and cholesterol crystal clefts. Electron microscopy of the intimal atheroma revealed dilatations between opposing endothelial cells which contained a flocculent material, similar to that seen in the subendothelial space. The subendothelial compartment was filled with collagen, extracellular lipid, vesiculated material and cell processes. Fibroblast like interlamellar cells and numerous intimal smooth muscle cells were seen. Numerous foam cells were also observed in the intimal atheromas.

In this study, spontaneous atherosclerosis occurred more frequently in adult and old pigeons than in young pigeons. This finding is in agreement with that reported in humans (Kumar *et al.*, 2003) and in birds (Bavelaar and Beynen, 2004). No effect of sex, weight and health status of the pigeons could be observed on the prevalence of spontaneous atherosclerosis. This finding is in

discrepancy with that of others in humans (Kumar *et al.*, 2003). This could be due to species difference and the limited number of pigeons examined in the present study.

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