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Comparison of the Abdominal Aorta and Renal Artery in the Neonate Male Dog

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Abstract: There has been no report about comparison of the abdominal aorta and renal artery in the neonate dog. So, it was decided to compare these two arteries in the neonate dog. Six normal neonate male dogs were studied. The specimens were processed in the routine way for electron microscopy. It was established that the only cell type found in the tunica intima was endothelium in both abdominal aorta and renal artery. In abdominal aorta, there were open connective tissue space, contains elastic fibers between the internal elastic membrane and the endothelium. In renal artery, endothelial cells attached directly to the internal elastic membrane and in some place, the internal elastic membrane interrupted for as much as a few microns. The only cell type was found in the abdominal aorta and renal artery tunica media was smooth muscle cells. There were more dense bodies in the renal artery smooth muscle cells than in the abdominal aorta. In the abdominal aorta tunica media, it was observed layers of smooth muscle cells alternate with elastic lamellae but in the renal artery, the smooth muscle cells were close to each other and a small quantity of collagen and elastic fibers were found between them. The adventitia of the abdominal aorta and renal artery was consisting of scattered fibroblasts among bundles of collagen and elastic fibers. Elastic fibers in tunica adventitia of renal artery were more than those in abdominal aorta.

Key words: Abdominal aorta, renal artery, ultrastructural, neonate dog, elastic fiber, adventitia, Iran

INTRODUCTION

Generally, the structure of the aortic wall and renal artery defined as elastic and muscular (Junqueira *et al*., 2005). It has been showed that in all animals, the only cell type in the aorta tunica media was smooth muscle cells but in the avian species was shown not only smooth muscle cells but also connective tissue cells as 2nd major cell type (Toda *et al*., 1984). Morphological features such as presence of intimal folds, pattern of the medial myoconnective components with segmental variations in the number of elastic lamellae was higher in the thoracic aorta to compare with the abdominal aorta in dog (Orsi *et al*., 2004). In domestic swine renal artery, it was established that the internal elastic membrane shows an expressed degree of wrinkliness. It was found a great quantity of mast cells in the middle shell (Vodenicharov and Cirnuchanov, 1995). The position of the left and right renal arteries was observed in dogs and it was reported that 90.28% of dogs have single renal artery and 9.72% have double renal arteries (Sajjarengpong and Adirektaworn, 2006). Aorta and renal artery in several species have been described (Gerrity and Cliff, 1972; Woezik *et al*., 1983; Lindell and Olin, 1957) but there has been no report about comparison of abdominal aorta and renal artery in neonate dog. So, it was decided to compare these two arteries in neonate dogs. In this report, we compare the structural feature of the abdominal aorta and renal artery in neonate dog based on morphological analyzed using transmission electron microscopy.

MATERIALS AND METHODS

Six abdominal aorta and renal artery were harvested from six clinically healthy neonate male dogs. Dogs were euthanized with an overdose of anesthetic (thiopental sodium). The abdominal cavity was opened and the abdominal aorta and renal artery exposed. After removal of these two arteries, samples were rinsed with normal saline and fixed in 2.5% glutaraldehyde for 8 h.

The specimens were rinsed with cold buffer washing and post fixed in 1% osmium tetroxide for 2 h. Next, dehydration was in a graded series of alcohol and clearing with the additioning of propilenoxide. After that the specimens were infiltrated in the mixture of propilenoxide and epon resin. The samples were embedded in epon 812 resin, transverse sections were made stained with uranyl acetate and the structure of the transitional zone was studied.

RESULTS AND DISCUSSION

The present study attempts to be a comprehensive survey of morphological features of the abdominal aorta and renal artery in the neonate dog. The only cell type found in the tunica intima was endothelium in both abdominal aorta and renal artery (Fig. 1, 2). In abdominal aorta, the internal elastic membrane was a thick sheet of elastin. There was open connective tissue space between the main mass of the internal elastic membrane and the endothelium. Such space contained elastic fibers that are branch of internal elastic membrane. In the internal elastical side of endothelium were seen areas of elastic fibers that probably elastin formation was in progress (Fig. 1). This space previously has been observed in aorta

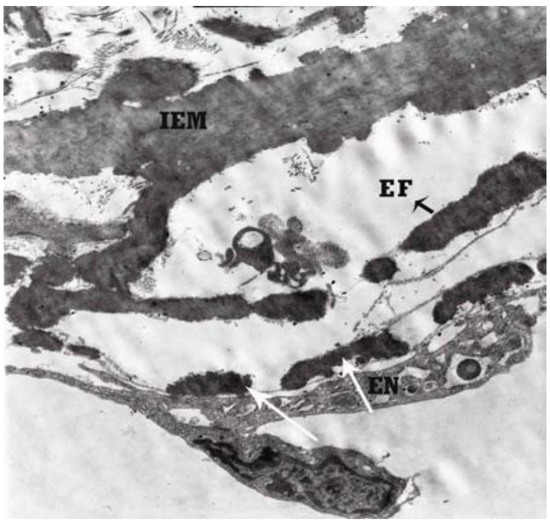

Fig. 1: Photomicrograph-abdominal aorta tunica intima in neonate dog. Internal Elastic Membrane (IEM), Endotelium (EN), Elastic Fibers (EF), arrowed: elastin formation ×5610

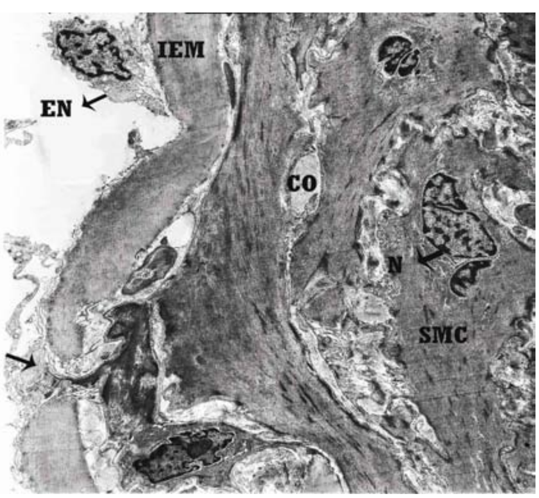

Fig. 2: Photomicrograph-renal artery tunica intima in neonate dog. Internal Elastic Membrane (IEM), Endotelium (EN), Collagen Fibers (CO), Smooth Muscle Cells (SMC), Nucleus (N), arrowed: interrupt ×2950

wall of the rat (Pease and Paule, 1960). In renal artery, a thick internal elastic membrane was observed that endothelial cells attached directly to it. In some place, the internal elastic membrane interrupted for as much as a few microns. In the vicinity of such fenestrations, collagen, island of elastin and even extrusions of muscle cell protoplasm (Fig. 2). There were not similar fenestrations in the abdominal aorta of neonate dog. But similar fenestrations have been observed in the aorta of other animals by conventional microscopy as well as in smaller vessels by electron microscopy (Moore and Ruska, 1957; Parker, 1958).

The only cell type which was found in the abdominal aorta and renal artery tunica media was smooth muscle cells. Myofilaments were found throughout most of the cytoplasm of the smooth muscle cells. Smooth muscle cells in the walls of these two arteries contained conspicuous dens bodies which underlie the cell surface and between myofilaments. In contrast, dens bodies were more numerous in the smooth muscle of the renal artery than in abdominal aorta (Fig. 3 and 4). These bodies previously have been observed in smooth muscle cells in varying detail by Parker (1958) and Mark (1956).

They are attachment devises, anchoring the system of myoflaments to the cell surface (Pease and Molinari, 1960). In the renal artery, the smooth muscle cells were close to each other and a small quantity of collagen and elastic fibers were found between them. In the space between smooth muscle cells, collagen fibers were more than elastic fibers (Fig. 4). In the abdominal aorta tunica

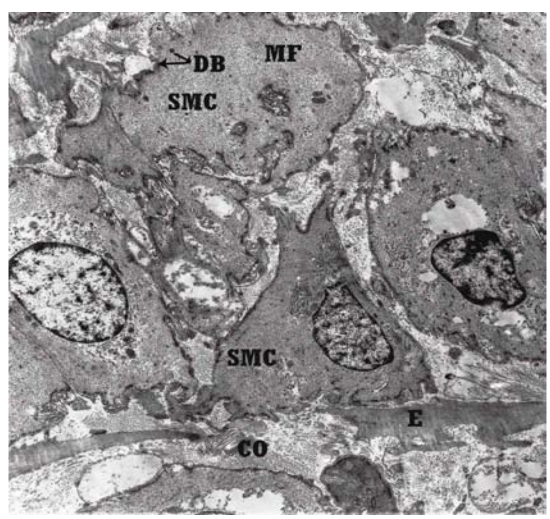

Fig. 3: Photomicrograph-abdominal aorta tunica media in neonate dog. Collagen Fibers (CO), Smooth Muscle Cells (SMC), Nucleus (N), Elastic Lamellae (E), Myofilament (MF), Dens Bodies (DB) ×8900, Bar = 1.98 μm ×3900

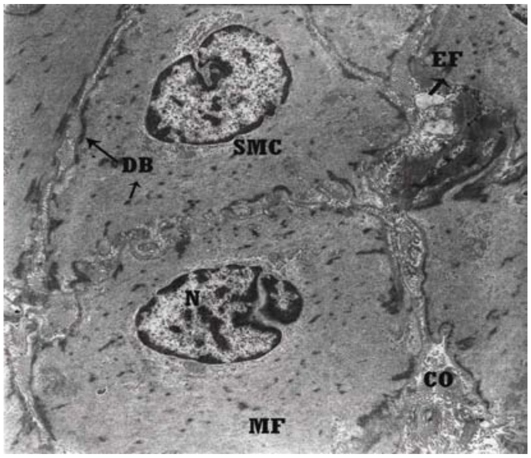

Fig. 4: Photomicrograph-renal artery tunica media in neonate dog. Elastic Fibers (EF), Collagen Fibers (CO), Smooth Muscle Cells (SMC), Nucleus (N), Myofilament (MF), Dens Body (DB) ×5200

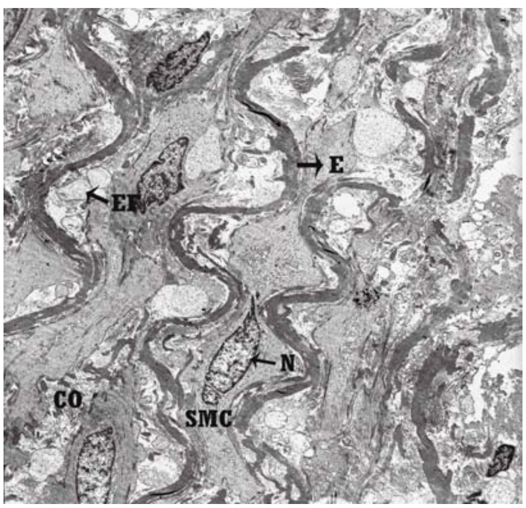

Fig. 5: Photomicrograph-abdominal aorta tunica media in neonate dog. Elastic Fibers (EF), Collagen Fibers (CO), Smooth Muscle Cells (SMC), Nucleus (N), Elastic lamellae (E) ×1650

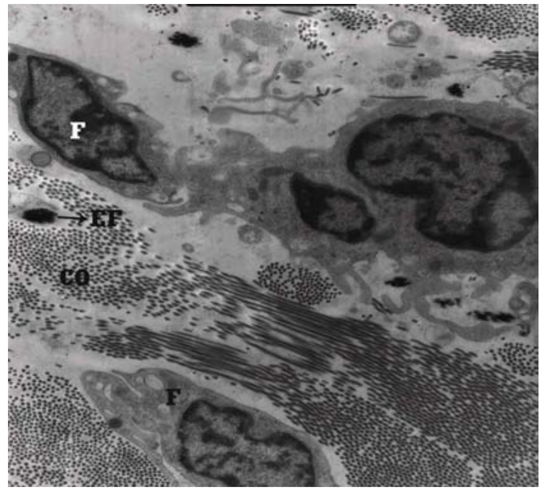

Fig. 6: Photomicrograph-abdominal aorta tunica adventitia in neonate dog. Elastic Fibers (EF), Collagen Fibers (CO), Fibroblast (F) ×5200

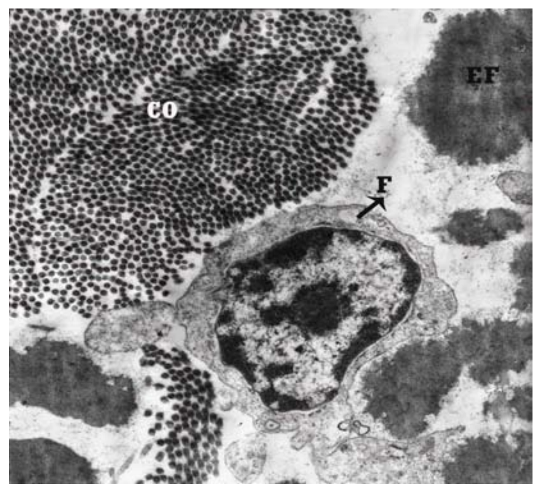

Fig. 7: Photomicrograph-renal artery tunica adventitia in neonate dog. Elastic Fibers (EF), Collagen Fibers (CO), Fibroblast (F) ×11500

media, it was observed layers of smooth muscle cells alternate with elastic lamellae. These elastic lamellae were essentially continous sheets of considerable thickness. Immediately, adjacent to their surface there were connective tissue space containing collagenous fibers quantity (Fig. 5). We know that during systole, the blood enters the large elastic arteries with considerable force and these arteries distend. They are able to do so because of the large amount of elastic tissue in their walls and during diastole the arteries return to their original size because of the elastic recoil of the walls. The flow of blood to the organ is controlled by the contraction or relaxation of the smooth muscle cells of the tunica media (Junqueira *et al*., 2005). Therefore, the existence of more elastic fibers in the abdominal aorta to compare with the renal artery and the replacement of elastic fibers by smooth muscle cells in the renal artery can be viewed as physiological. The adventitia of the abdominal aorta and renal artery was consisting scattered fibroblasts among bundles of collagen and elastic fibers. Elastic fibers in tunica adventitia of renal artery were more than abdominal aorta (Fig. 6 and 7). We know that elastic rebound helps to maintain arterial pressure (Fourman and Moffat, 1971) and existence of more elastic fibers in the renal artery tunica adventitia is gives reason to believe that they probably have role in maintain arterial pressure.

CONCLUSION

Aorta and renal artery in neonate dog show some differences. These differences presumably reflect adaptation to the functional of these two arteries.

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