ABSTRACT

The aim of this study was to describe the anatomical arrangement of the branches arising from the dorsal surface of the aorta abdominalis in the rabbit and the hare. The study was carried out on ten adult rabbits and ten adult European hares using the corrosion technique. After the euthanasia, the vascular network was perfused with saline. After polymerization of the casting medium, the maceration was carried out in a KOH solution. We found different variations in; the number of arteries, level of their origin and arrangement. The aa. lumbales of the same level arose by means of a common trunk or their origin was independent. The aa. lumbales VI or aa. lumbales VI et VII originated also from the a. sacralis mediana. By aa. lumbales we found an important interspecies difference in; number, diameter, ramification and density of dorsal branches, which are designated for the dorsal muscles of the body stem. All listed parameters of branches were higher in the hare. This anatomical arrangement of dorsal branches is adapted to the higher movement activity of the hare. According to our results, it can be concluded that the anatomical arrangement of the branches of the aorta abdominalis shows a higher number of variations in the domesticated rabbit in comparison with the hare.

Key words: abdominal aorta; a. sacralis mediana; aa. lumbales, hare; rabbit

INTRODUCTION

One of the most frequently occurring wild animals in Europe is the European hare. Despite its relatively abundant occurrence, there is a significant gap of knowledge about its anatomy in the literature. Up to now, the works dealing with the study of the arterial system in the European hare have only been published sporadically [3], [4]. Variations in the origin, branching and course of several arteries have long received attention of anatomists, surgeons and particularly vascular specialist. The variations in the arterial system of several species are the object of interest in a large number of studies [8]. The arterial arrange-
ment of the branches arising from the *aorta abdominalis* was studied in several experimental animals, such as; dogs [1], cats [2], rabbis [5], rats [17] and guinea pigs [15].

The aim of this study was to compare the variations of the *aorta abdominalis* branches arising from its dorsal surface in the domesticated rabbit and the European hare.

**MATERIALS AND METHODS**

This study was carried out on 10 adult European hares (*Lepus Europaeus*, L. 1758, age 140 days) and on 10 adult rabbits (*Oryctolagus cuniculus f. domestica*, L. 1758, age 140 days). We used hares (obtained from ISFA APRC, Nitra, Slovak Republic) of both sexes (female n = 5; male n = 5) with a weight range of 2.5—3.2 kg and New Zealand White rabbits (obtained from HYLAPA s.r.o., Prešov, Slovak Republic) of both sexes (female n = 5; male n = 5) with a weight range of 1.8—2.3 kg in an accredited experimental laboratory of the University of Veterinary Medicine and Pharmacy in Kosice. The animals were kept in cages under standard conditions (temperature 15—20°C, relative humidity 45%, 12-hour light period), and fed with a granular feed mixture (O-10 NORM TYP, Spišské kŕmne zmesi, Spišské Vlachy, Slovak Republic). The drinking water was available to all animals *ad libitum*. The animals were injected intravenously with heparin (50000 IU.kg⁻¹) 30 min before they were sacrificed by intravenous injection of embutramide (T-61, 0.3 ml.kg⁻¹). Immediately after euthanasia, the vascular network was perfused with a physiological solution [10]. During manual injection through the ascending aorta, the right atrium of the heart was opened in order to lower the pressure in the vessels in order to ensure an optimal injection distribution. Batson’s corrosion casting kit No. 17, using a volume of 50 ml (Dione, České Budějovice, Czech Republic) was used as the casting medium. The maceration was carried out in a 2—4% KOH solution for a period of 5 days at 60—70°C. This study was carried out under the authority of decision No. 2647/07-221/5.

**RESULTS**

The paired *aa. lumbales* arose from the dorsal surface of the *aorta abdominalis* as segmental vessels. They supplied the lumbar spinal cord, lumbar vertebrae, muscles of the back, inner lumbar muscles and skin of the back. In the rabbit, the independent origin of the *aa. lumbales* was pres-
Fig. 2. *Aa. lumbales* and *a. sacralis mediana* in the hare. 1 — *vertebra lumbalis* I; 2 — *vertebra lumbalis* V; 3 — *aorta abdominalis*; 4 — *a. lumbalis* V; 5 — *a. sacralis mediana*. Macroscopic image, lateral view

Fig. 3. *Rr. dorsales* arising from *aa. lumbales* in the rabbit. 1 — *vertebra lumbalis* IV; 2 — *vertebra lumbalis* VI; 3 — *rr. dorsales*. Macroscopic image, dorsal view
ent in the first pair in 20% of the cases, in the first two pairs in 20% of the cases and in the first three pairs in 10% of the cases. In the remaining cases, the paired aa. lumbales originated by means of a common trunk at each level (Fig. 1). In the hare, the first pair originated independently in 20% of the cases and the first two pairs in 60% of the cases. In the remaining cases, the paired aa. lumbales originated by means of a common trunk at each level (Fig. 2). From the aa. lumbales arose rr. dorsales supplying the muscles of the body stem. In the rabbit, from each a. lumbalis arose rr. dorsales in number of 3—6 and in the hare in number of 7—9. Also their diameter, ramification and density were higher in the hare in comparison with the rabbit (Fig. 3, 4).

The a. sacralis mediana was the direct continuation of the aorta abdominalis. It ran ventrally to the sacrum, to reach the coccygeal vertebrae and continued caudally as a. caudalis mediana. In the rabbit, a. sacralis mediana originated from aorta abdominalis at the level of the 6th lumbar vertebra (Fig. 1). From a. sacralis mediana in the rabbit arose the last pair of aa. lumbales in 30% of the cases and last two pairs in 70% of the cases (Fig. 1). In the hare, the origin of a. sacralis mediana was located at the level of the 5th lumbar vertebra in 60% of the cases (Fig. 2) and at the level of the 6th lumbar vertebra in 40% of the cases. From a. sacralis mediana in the hare originated the last pair of aa. lumbales in 20% of the cases and last two pairs in 80% of the cases (Fig. 2).

**DISCUSSION**

The knowledge of anatomical variations is important for radiological and surgical procedures in humans and other animals due to its practical and theoretical significance for experimental research and surgical practice in experimental and domesticated animals [11], [12], [16].

Six pairs of aa. lumbales with symmetrical origin from the dorsal surface of the aorta abdominalis were found in the rabbit [13]. Krause [9] described, in the rabbit, the aa. lumbales as branches arising from the dorsal surface of the aorta abdominalis by means of a common trunk. This arrangement was found by the aa. lumbales I—VI. The aa. lumbales VII were arising by means of a common trunk with an origin from a. sacralis mediana. This unpaired artery arose from the dorsal surface of the aorta abdominalis at the level of aortic bifurcation. P o p e s k o et al. [13] described a. sacralis mediana in the rabbit as an independent branch arising from the dorsal surface of the aorta abdominalis. From the a. sacralis mediana arose the aa. lumbales.
VII. In the majority of cases in our study, the aa. luminales arose by means of a common trunk and the a. sacralis mediana gave off the aa. luminales VI et VII.

The well-developed rr. dorsales arising from the aa. luminales in the hare was the most visible interspecies difference in our study. These differences are associated with the way of life. The wild living hares are better and permanently trained. Training induces dimensional adaptations of the vascular system concerning the vessel diameter, distensibility, density and wall thickness in a proportional manner [7].

There is a very significant gap in the literature concerning the description of the arterial system in the European hare. The anatomical differences between familiar species will help to understand the behavioral differences in the wild and domesticated animals. We hope that this work will be the starting point for possible future studies in this research area. Such knowledge is also critical in comparative studies across species, as well as in the professional’s daily practice [6].

CONCLUSIONS

A good understanding of the anatomical variations can facilitate surgical interventions, including the interpretation of a number of modern medical procedures of clinical interest, such as computed tomography and angiography [14]. Therefore, both the normal and variant anatomy of the region should be well known for accurate diagnosis, better treatment and avoidance of iatrogenic injuries during interventional vascular procedures.

REFERENCES


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