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Anatomical Study of the Grasscutter's Aorta (*Thryonomys swinderianus*, Temminck 1827)

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Abstract

Introduction: The largest artery in the body, from which practically all other arteries originate, knowledge of the anatomy of the grasscutter's aorta, an anatomical model, is important. **Aim:** We aim to describe the grasscutter's aorta and identify its main branches. **Materials and methods:** This was a morphological, cross-sectional, and descriptive study of the aortas of five large grasscutter species. Final killing was performed by exsanguination from the left ventricle after a thoraco-abdominal part under general anesthesia. Aorta dissections were performed on fresh grasscutter species and after vascular injection of colored latex. The parameters studied were the origin, route-termination, main branches, and the length and diameters of the aorta. **Results:** The aorta originated at the base of the left ventricle and terminated at the entrance to the pelvic cavity after an initial course describing an arch and then a nearly medial thoracic and abdominal segment in the cranio-caudal direction. The main branches were two coronary arteries, two supra-aortic trunks, a constant celiac trunk, either one mesenteric artery or two mesenteric arteries. The average length of the aorta was 132.48 mm with average diameters of 1.60 mm; 1.46 mm and 1.04 mm respectively at the ascending aorta, the descending thoracic aorta, and the abdominal aorta. **Conclusion:** The grasscutter's aorta qualitatively presents the same main branches as that of humans.

Keywords: Aorta, anatomy, grasscutter, Lomé-Togo

Introduction

The use of animal models for scientific research and clinical purposes is an ancient practice motivated by the anatomical similarities between humans and certain mammals. An animal model is, according to the American National Research Council Committee on Animal Models for Research and Aging, a model that allows the study of reference data on biology or behaviour, or in which a spontaneous or induced pathological process can be studied, the latter having one or more aspects in common with an equivalent phenomenon in humans or other animal species (Barré-Sinoussi et al., 2015). Through these models, comparative anatomy has been studied, physiopathological mechanisms have been discovered, and new diagnostic or therapeutic methods developed. In African countries, animal models have always been imported from Western countries, posing problems of accessibility and financial cost. To overcome these difficulties, researchers in West Africa began by focusing on the grasscutter with a view to making it the animal model par excellence. The resurgence of scientific interest in this potential model aroused the carrying-out of several studies (Broalet et al., 2019, 2021; James et al., 2016). In one of our recent studies on this specimen, we noted the particularity of the coronary arteries; the first branches of the grasscutter's aorta (Sogan et al., 2025). With a view to completing the knowledge of its vascular system, namely the other main arterial branches and the dimensions of the aorta of this model, we decided to carry out this study.

Materials and methods

This was a morphological, cross-sectional, and descriptive study of the grasscutter's aorta and its main branches. The study concerned five adult grasscutters from domestic breeding farm.

Each grasscutter studied was kept in a fenestrated wooden crate; a cotton pad heavily soaked in halothane was placed next to the grasscutter in the crate. A few minutes later, after the animal was asleep, anesthesia was deepened by injecting ketamine at the base of its tail at a dose of 10 mg per kg. A thoraco-abdominal part was performed, and definitive death was achieved through exsanguination by draining the left ventricle. Vascular washing using heparinized saline was performed through the trocar implanted in the left ventricle and evacuated from the right atrium by a gravitational system. A 10 ml injection of red-dyed latex was performed from the left ventricle trocar. The animal was kept for seven days in a formalin solution, then in a refrigerator for two days. Dissections were performed before and after injection-formalinization.

The parameters studied were: origin, route, ending, dimensions, main side and terminal branches. Diameters and lengths were measured using a platform for biological-image analysis "Fiji ImageJ-win64" (Schindelin et al., 2012). The figures 1 and 2 illustrate the measurement of lengths and diameters during this work using the Fiji Image J-win64 application. These dimensions were taken from the fresh aorta before injections and formalinization. Note that for reasons of precision on the real origin of the aorta and a good identification of the large vessels of the base of the heart, the dissection of the heart of a fresh, non-formolated grasscutter was necessary to complete the data. The latter was not included in the measurements of the aorta.

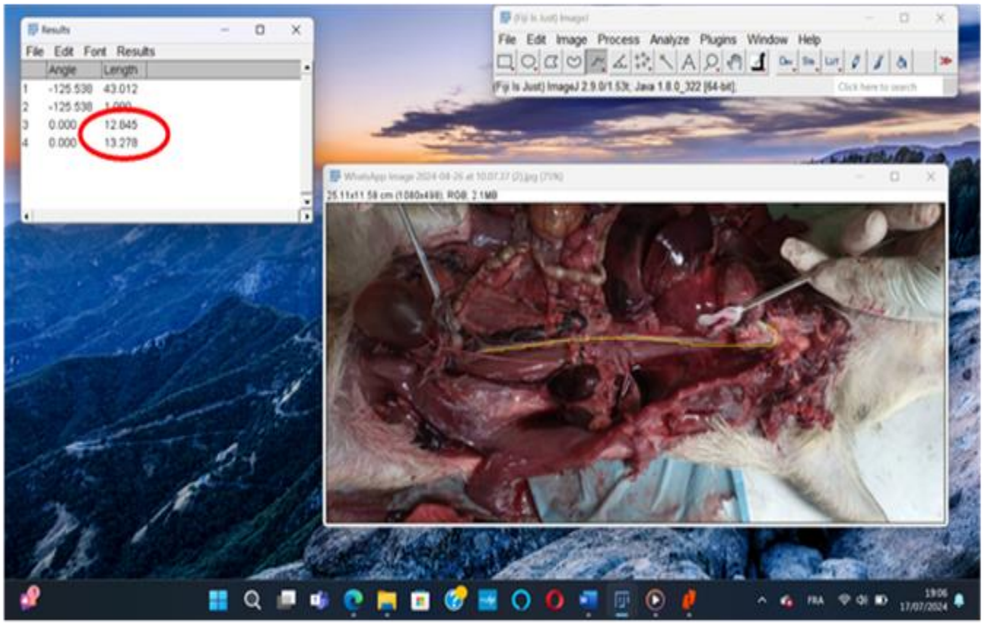

Figure 1: Illustrating aorta length measurements "in centimeter on the screen" (capture of our computer screen during measurements, yellow line)

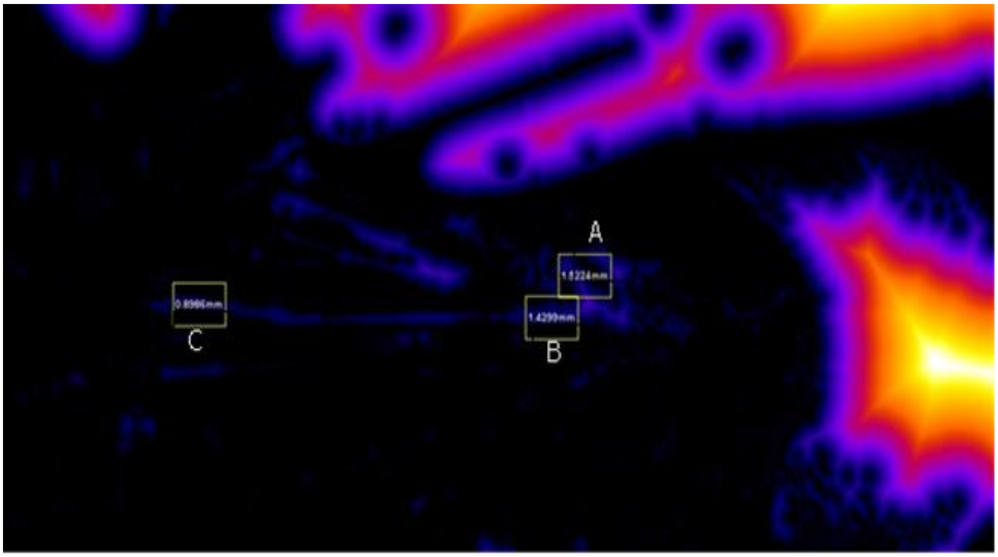

Figure 2: Illustrating aortic diameter measurements (captured on our computer screen during measurements); A : Ascending aorta; B : Thoracic descending aorta; C : Abdominal aorta

Results

Origin: It arises at the base of the heart at the level of the left ventricle, behind and to the right of the origin of the pulmonary artery trunk (figures 3 and 4).

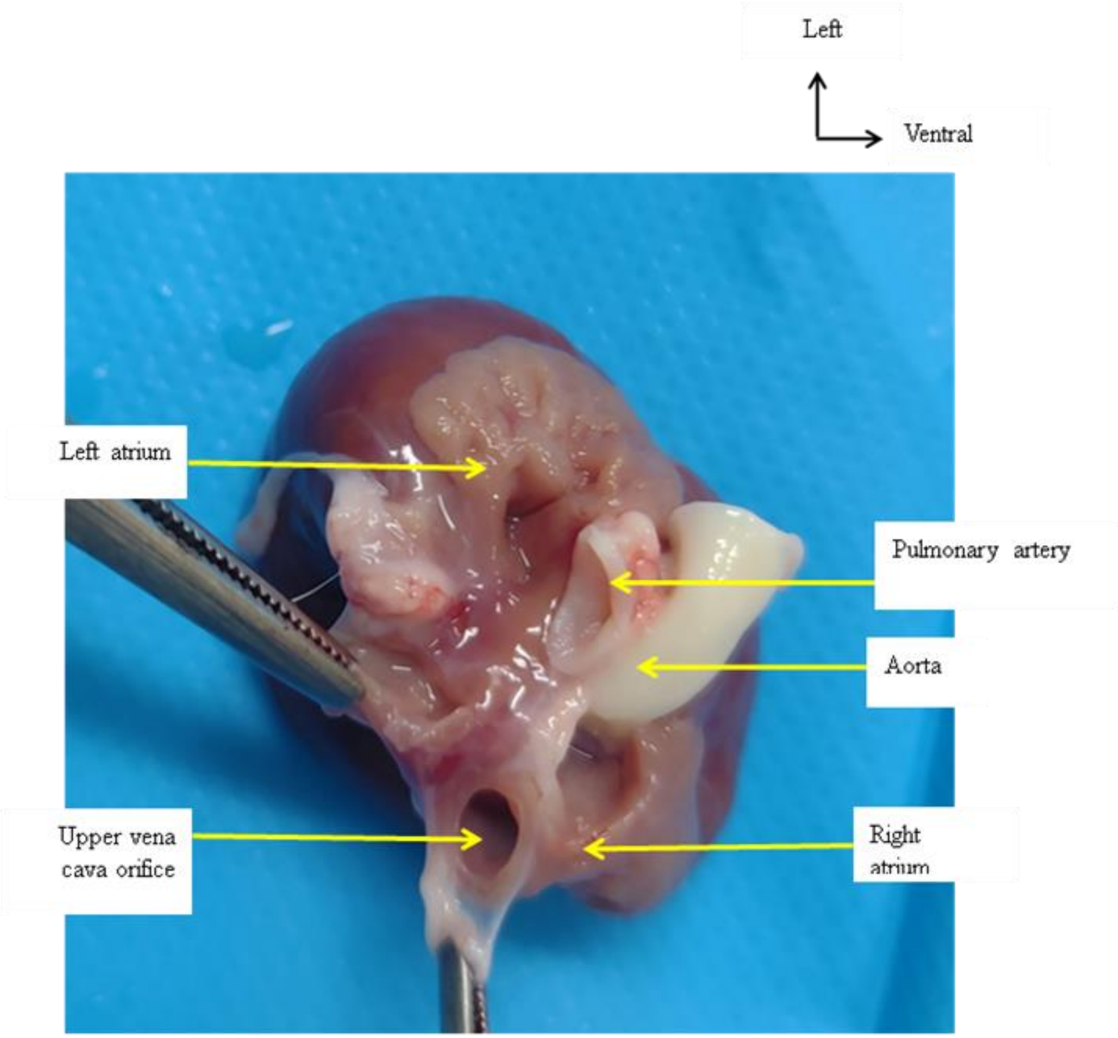

Figure 3: Showing the large vessels at the base of the Grasscutter heart

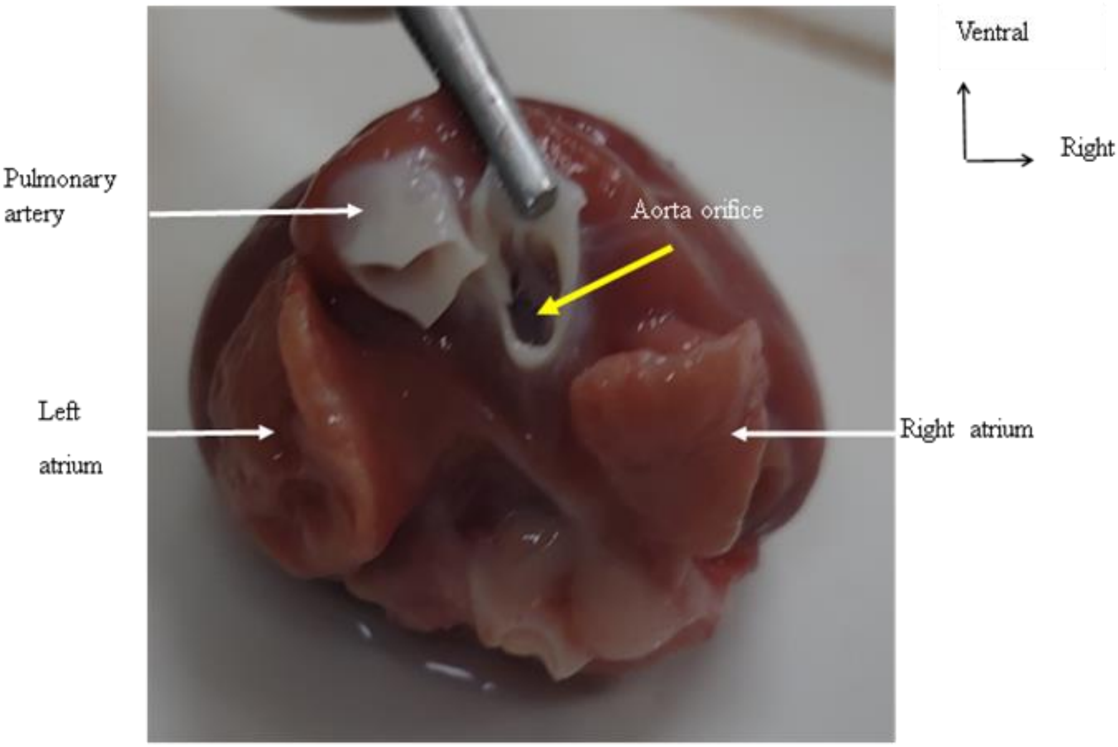

Figure 4: Showing aorta orifice (yellow arrow)

Overall route: From its origin, the aorta courses cranially and medially, describing an arch with a caudal and right concavity. It then courses caudally, crosses the diaphragm to the left of the esophageal orifice, and then becomes abdominal. Consequently, it is divided into two segments: a thoracic segment and an abdominal segment (Figure 5).

- *The thoracic segment*: after describing the arch, it courses transversely and caudally in a left paramedian position toward the aortic orifice of the diaphragm. About one centimeter from this orifice, it is deviated slightly to the right.
- *The abdominal segment*: From the aortic orifice of the diaphragmatic artery, it runs transversely toward the pelvic cavity to the left of the caudal vena cava.

Ending: It arises at the entrance to the pelvic cavity by bifurcation anteriorly and to the left of the origin of the caudal vena cava (figure 5).
Main terminal branches: They are represented by two iliac arteries (left common iliac and right common iliac); the right passes anterior to the initial portion of the inferior vena cava (figure 5).

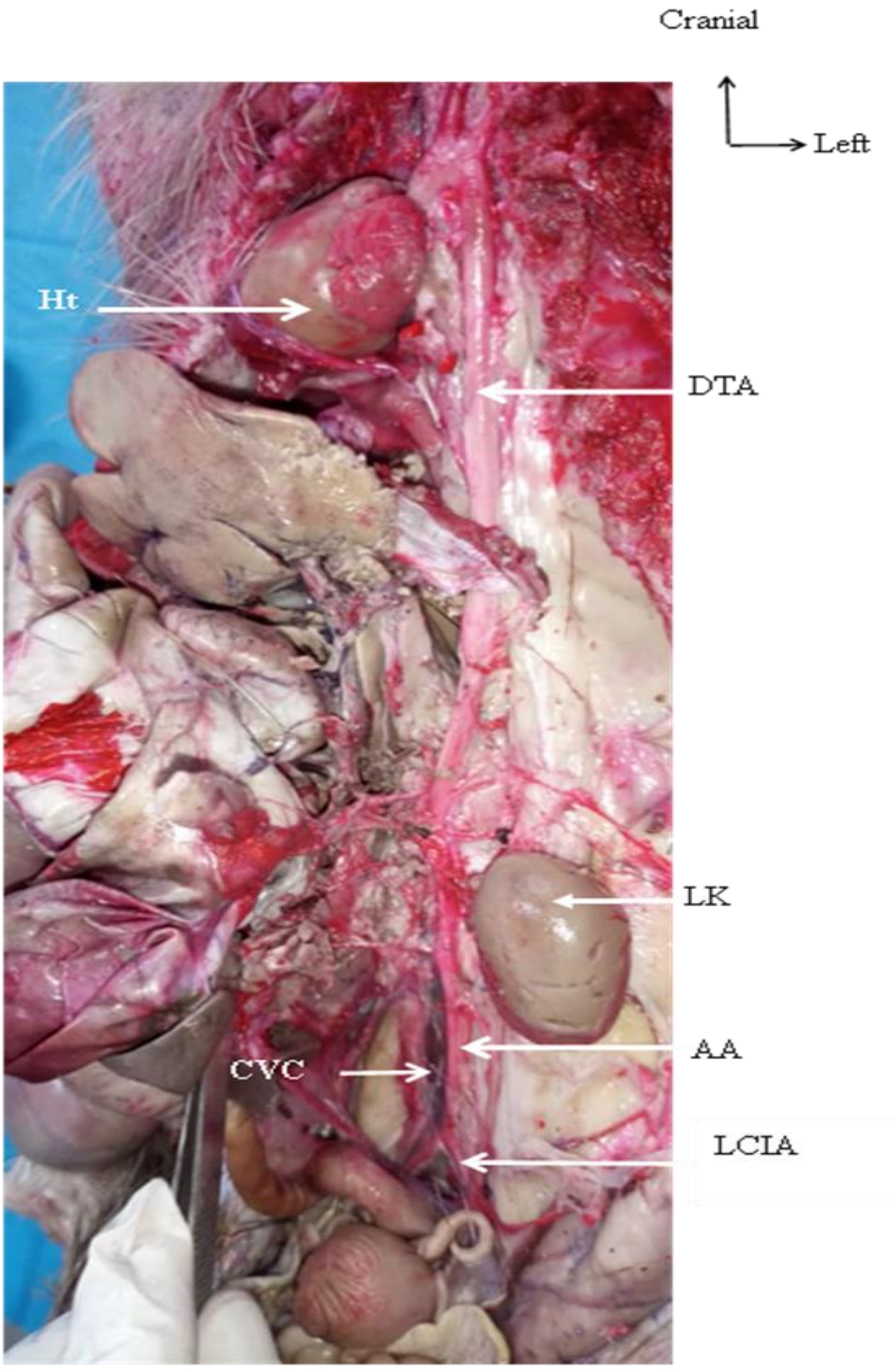

Figure 5: Overview of the aorta from origin to termination
Ht: heart; CVC: caudal vena cava; LCIA: left common iliac artery; AA: abdominal aorta; LK: left kidney; DTA: descending thoracic aorta

Main side branches:

- *At the level of the thoracic aorta*, they are represented by two coronary arteries, left and right at the base of the aorta as shown in our article about coronary arteries (Sogan et al., 2025); two supra-aortic trunks: the common carotid trunk and the left subclavian artery, heading toward the cephalic extremities and forelimbs.
- *At the level of the abdominal aorta*, the following main branches are noted (figure 6): a celiac trunk; a single mesenteric artery was present in two out of five cases; in three out of five cases, we observed a large cranial mesenteric artery and a smaller caliber caudal mesenteric artery. Other branches observed on the abdominal aorta were: two renal arteries (left and right); two genital arteries (right and left); lumbar and caudal phrenic arteries.

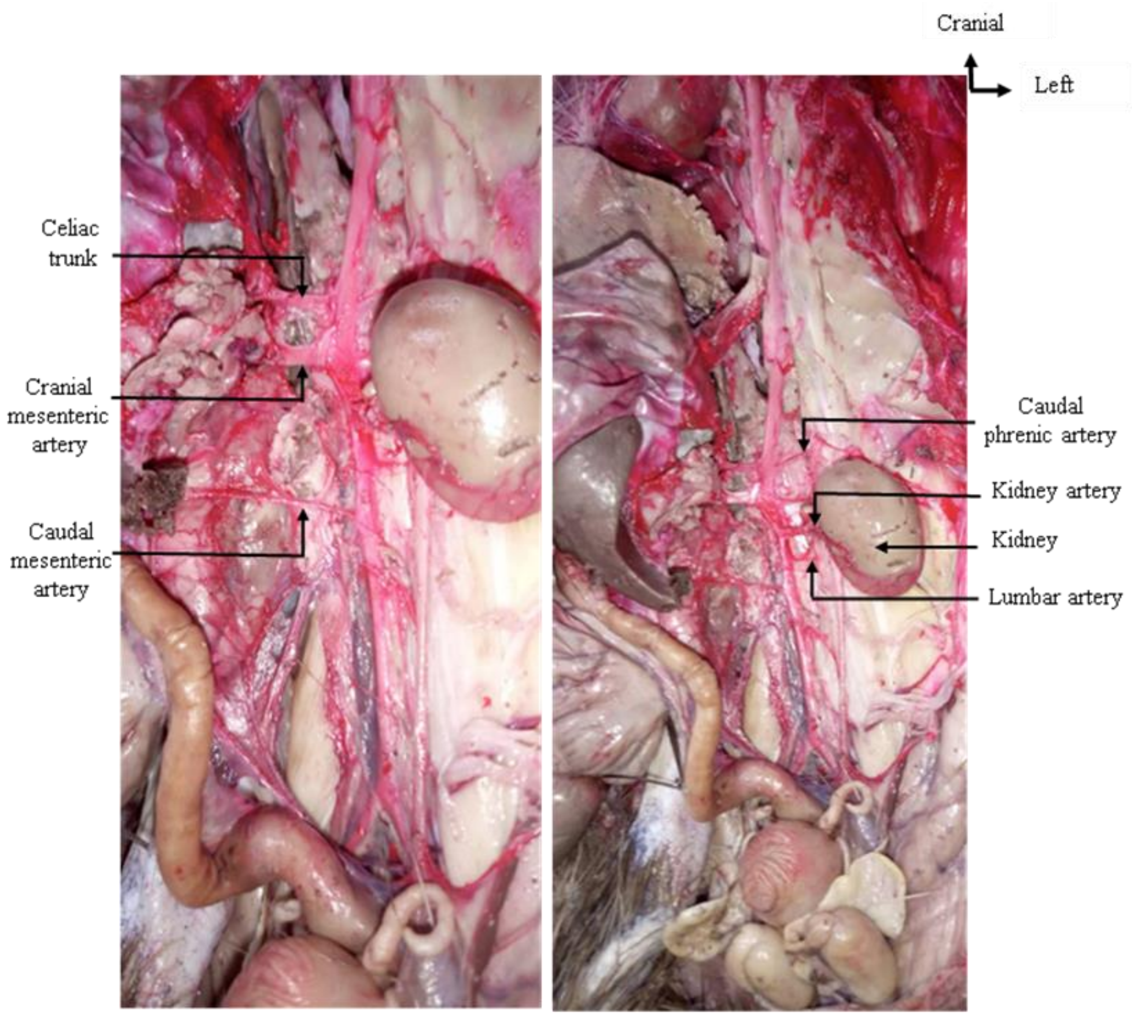

Figure 6: Showing the abdominal branches of the aorta

Dimensions

The medium aortic length was 132.48 mm with medium diameters of 1.60 mm; 1.46 mm and 1.04 mm respectively at the ascending aorta, the descending thoracic aorta and the abdominal aorta (tables I and II).

Table 1: Grasscutter's characteristics and aorta length

	Age (mounth)	Height (kilograms)	Aorta length (millimeter)
Grasscutter 1	12	3,7	128,4
Grasscutter 2	15	4,7	132,7
Grasscutter 3	10	4,1	130,6
Grasscutter 4	18	5,2	140,5
Grasscutter 5	14	4,0	130,2

Table 2: Grasscutter aorta segment diameters

	Ascending thoracic aorta (in millimeter)	Descending thoracic aorta (in millimeter)	Abdominal aorta (in millimeter)
Grasscutter 1	1,52	1,42	0,89
Grasscutter 2	1,45	1,39	1,02
Grasscutter 3	1,61	1,48	1,16
Grasscutter 4	1,85	1,55	1,05
Grasscutter 5	1,58	1,48	1,10

Discussions

Anatomical studies of vessels have been based on vascular injections since time immemorial. Even though these methods are increasingly being replaced by new imaging technologies and Artificial Intelligence, they still retain their place in basic research. Using this anatomical technique, we were able to obtain results on the grasscutter's aorta even though the very fine branches could not be properly objectified for a good description.

We noted two coronary arteries, just like in humans, rats, and rabbits, at the base of the grasscutter's aorta. Of the five grasscutters manipulated, no anatomical variations were observed. However, in humans, variations are not uncommon, such as the absence of the left coronary artery or the bifurcation of the right artery at birth (Francois et al., 2020; Demirkol et al., 2013; Afassinou et al., 2025).

Apart from the coronary arteries, the main branches of the thoracic aorta were represented by two supra-aortic trunks: a bi-carotid trunk and a left subclavian artery. This anatomical defining feature has already been highlighted by James and others in their studies (James et al., 2016). Compared to other laboratory specimens, namely the rabbit, in 94% of cases, the left common carotid arises from the bifurcation of the brachio-cephalic trunk as in the grasscutter but in 4% of cases it comes directly from the aortic

arch thus bringing the supra-aortic trunks to three in these cases (Ding et al., 2016). In mice the existence of the three supra-aortic trunks was demonstrated by Sawada and others (Sawada et al., 2019). In humans, in modal anatomy there are three trunks arising from the aortic arch; however, varieties are not rare. Thus, in 24% of cases, authors note the emergence of two supra-aortic trunks: a common trunk which will give the brachio-cephalic trunk and the left common carotid, then a trunk which represents the left subclavian artery, just like in the grasscutter (Aboulhoda et al., 2019). In this case, we speak of an anatomical variation in the bovine arch in humans.
On the abdominal segment of the aorta, the arteries going to the digestive system vary from two to three; in other words, we have noted a constant celiac trunk associated either with a single mesenteric artery or with two mesenteric arteries.

The celiac trunk is also constant in the rat and the rabbit, just like in humans where it is destined for the organs of the supra-mesocolic level of the abdomen. The cranial mesenteric artery originates just below the celiac trunk, usually in grasscutters, rats, rabbits and humans. However, this origin can be either in common with the right renal artery, or at the same level or below it in rats (Vdoviaková et al., 2016); or else in humans, it forms a common trunk with the celiac trunk, constituting in this case the mesenterico-celiac trunk, rare but reported in the literature (Ciçekcibaşi et al., 2005).

The caudal mesenteric artery was inconstant in our work; when it existed, it participated in the vascularization of the distal colon; it was absent in two out of five cases. It is constant in rats and is destined for the left colon (left colic artery) and the rectum (cranial rectal artery) just like in humans. In the grasscutter, it arises from the ventral surface of the aorta, higher up and far from the terminal bifurcation of the aorta, unlike what is observed in humans.

The two genital arteries arise directly from the abdominal aorta in a high position, forward and laterally very close to the renal arteries, like in humans. The same arrangement has been observed in the rabbit, with a right genital artery arising slightly higher than the left (Kigata et al., 2020). This again demonstrates the existence of anatomical similarities between humans, the grasscutter, and the rabbit regarding the mode of emergence of the genital arteries.

The other branches found were the caudal lumbar and phrenic arteries. We do not focus on these parietal arteries, nor on their namesakes in the thoracic segment, because the latex used did not allow the study of these very fine vessels.

Conclusion

The largest artery in the body, the grasscutter's aorta, qualitatively presents the same main branches like in humans. Quantitatively, nuances have been identified; it is a question of specific features that must be taken into account when carrying out experiments on this grasscutter's artery for clinical purposes.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

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References:

1. Aboulhoda, B.E., Ahmed, R.K., & Awad, A.S. (2019). Clinically-relevant morphometric parameters and anatomical variations of the aortic arch branching pattern. Surgical and Radiologic Anatomy; 41(7): 731-744. https://doi.org/10.1007/s00276-019-02215-w
2. Afassinou, Y.M., Abomo, S., Pessinaba, S., Sogan, A., Atta, B., Pio, M., Baragou, S., Damorou, F., & Adjenou, V. (2025). Variabilité radioanatomique des artères coronaires à la coronarographie à Lomé. J Afr Imag Méd ; 17(1): 1-8. doi: 10.55715/jaim.v17i1.744
3. Barré-Sinoussi, F., & Montagutelli, X. (2015). Animal models are essential to biologicalresearch: issues and perspectives. Future science OA, Volume 1, Issue 4, FSO63. doi/full/10.4155/fso.15.63
4. Broalet, E., Afanvi, H. M., James, Y. E., Zunon-Kipré, Y., & Tako, A. (2021). La vascularisation du tronc cérébral de l'aulacode (Thryonomys swinderianus, Temminck 1827). Morphologie ; 105(350) : S48. https://doi.org/10.1016/j.morpho.2021.05.099
5. Broalet, E., Afanvi, H. M., Kamissoko, Y., & Tako, A. (2019). Étude anatomique de l'artère vertébrale de l'aulacode (Thryonomys swinderianus, Temminck, 1827). Morphologie ; 103(342) : 117. https://doi.org/10.1016/j.morpho.2019.09.024
6. Çiçekcibaşi, A.E., Uysal, I.I., Seker, M., Işık, T., Mustafa, B., & Ahmet, S. (2005). A rare variation of the coeliac trunk. Annals of Anatomy 2005; 187(4): 387-391. https://doi.org/10.1016/j.aanat.2005.02.011
7. Demirkol, S., Balta, S., Arslan, Z., Ugur, K., & Atila, I. (2013). Absent left main trunk in a patient with subaortic membrane detected by three-dimensional echocardiography. European Heart Journal -

Cardiovascular Imaging; 14:37–37. https://doi.org/10.1093/ehjci/jes148.
8. Ding, Y.H., Dai, D., Layton, K.F., Debra, A.L., Mark, A.D., Ramanathan, K., Harry, J.C., & David, F.K. (2016). Vascular Anatomic Variation in Rabbits. Journal of Vascular and Interventional Radiology; 17(6): 1031-1035. https://doi.org/10.1097/01.RVI.0000220677.34695.29
9. Francois, J., Kariyanna, P.T., Jayarangaiah, A., Tobin, M., & Isabel, M. (2020). Absence of the Left Main Artery with Separate Ostia of the Left Anterior Descending Artery and Circumflex from the Left Sinus Valsalva: A Case Report. American Journal of Medical Case Reports ; 8:134–6. https://doi.org/10.12691/ajmcr-8-5-6.
10. James, Y.E., Espérance, B., Tchin, D., Yvan, Z.-K., Amegnona, A., Gagnon, A., Akpo, S., Messanvi, G., & Komlavi, J. (2016). Etude Anatomique du Système Artériel Carotidien de l'Aulacode (Thryonomysswinderianus, Temminck 1827). European Scientific Journal ; 12(12) : Article 12. https://doi.org/10.19044/esj.2016.v12n12p246
11. Kigata, T., & Shibata, H. (2020). Arterial supply to the rabbit male genital organs. The Journal of Veterinary Medical Science; 82(3): 254-260. https://doi.org/10.1292/jvms.19-0616
12. Sawada, H., Chen, J.Z., Wright, B.C., Jessica, J.M., Hong, L., & Alan, D. (2019). Ultrasound Imaging of the Thoracic and Abdominal Aorta in Mice to Determine Aneurysm Dimensions. Journal of Visualized Experiments; (145) e59013: 9 pages. https://doi.org/10.3791/59013
13. Schindelin, J., Arganda-Carreras, I., Frise, E., Kaynig, V., Longair, M., Pietzsch, T., Preibisch, S., Rueden, C., Saalfeld, S., Schmid, B., Tinevez, J.-Y., White, D. J., Hartenstein, V., Eliceiri, K., Tomancak, P., & Cardona, A. (2012). Fiji : An open-source platform for biological-image analysis. Nature Methods; 9(7): 676-682. https://doi.org/10.1038/nmeth.2019
14. Sogan, A., Hounakey, M.A., Laleye, C.M., James, Y. E., Broalet, E., Agbonon, A., & Hounnou, G.M. (2025). Anatomical Study of the Coronary Arteries of the Grasscutter (Thryonomys swinderianus, Temminck 1827). Int J Anat Res ;13(1):9109-9113. DOI: 10.16965/ijar.2024.243
15. Vdoviaková, K., Petrovová, E., Maloveská, M., Lenka, K., Jana, T., Mario, Z.J., & Darina, P. (2016). Surgical Anatomy of the Gastrointestinal Tract and Its Vasculature in the Laboratory Rat. Gastroenterology Research and Practice; 2632368: 11 pages. https://doi.org/10.1155/2016/2632368