

Morphology of the Left Atrial Appendage in the Senegalese: About 36 Anatomic Parts

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Abstract

Introduction: the left atrial appendage, a dormant embryonic vestige, would play a major role in cardiac hemodynamic changes, volume homeostasis and thrombi formation. It, therefore constitutes a therapeutic target. Its morphology is extremely variable. **Objective:** it consisted on determining the morphological variations of the left auricle as well as their interest in the prevention of thrombi in the Senegalese. **Material and Method:** This study was conducted by dissecting 36 fresh hearts from Senegalese anatomical subjects with a sampling of the left atrial appendage, including specimens with normal morphological appearance. Their morphology was studied using the fresh and frozen plaster molding method. The data obtained were analyzed statistically. **Results:** the average age of the subjects was 33 years, with a sex ratio of 1.06, the cauliflower shape was dominant with 57% of cases and the cactus shape (4%) was less frequent. The cauliflower shape presented a clear angulation compared to the others without statistically significant differences according to age. **Conclusion:** This work showed a great morphological variability of the left atrial appendage. It can provide an update on the specificity of Senegalese. Taking these variations into account is important in the safe management of hemodynamic conditions and the improvement of the management of recurrent strokes.

Keywords

Atrial Appendage, Morphology, Stroke

1. Introduction

The left atrial appendage (LA) has long been considered a dormant embryological structure. Formerly called auricular appendage [1] [2]. It is a complex functional organ that contributes to cardiac hemodynamic changes and volume homeostasis [2] [3], which makes it a therapeutic target [4] [5]. Work on CT and MRI images has recently shown its morphological classification into 4 main forms and demonstrated inequalities in terms of embolic risk [6] [7].

Anatomical works contain few detailed descriptions of the left atrial appendage, and local data are even rarer. The development of modern imaging techniques has enabled its description *in vivo* and has given renewed interest to the study of its morphology, knowledge of which is essential for the etiopathogenic analysis of stroke recurrences [8]-[10]. It is in this context that we undertook this work in order to study the morphological variants of the left atrial appendage, the consideration of which is essential for stent placement during its percutaneous closure.

2. Material and Method

This was a study by dissection of 36 fresh hearts from anatomical subjects, taken from the pathological anatomy departments of Idrissa Pouye and Dalal Jamm hospitals in Dakar. It included adult anatomical subjects of both sexes whose circumstances of death were not natural death or death linked to pathology or cardiac malformation.

The removed hearts were immersed in ice and sent to the anatomy and organogenesis laboratories of Dakar Cheikh Anta DIOP University and the Joint Research, Exploration and Diagnostic Unit of the UFR of Health Sciences of thiès Iba Der THIAM University, where they were kept in the freezer. This was followed by rinsing and dissection with resection of the left atrial appendage and their edges (**Figure 1**).

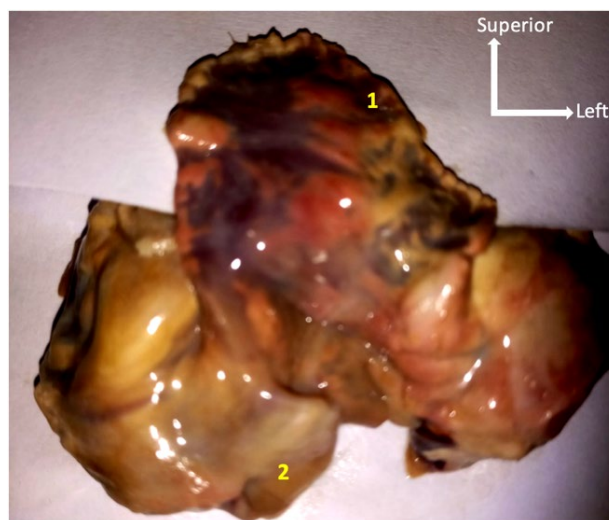


Figure 1. Left atrial appendage sampled with its banks. 1- left atrial appendage; 2- banks of left atrial appendage.

After collecting the sociodemographic data of each subject, we excised the left atrial appendage with an overhang on the original atrial walls, which we pinned on a plate. Then, we filled with semi-liquid plaster through a hole centered on the plate, the atrial appendage being suspended in a tray. After 24 hours of freezing (**Figure 2**), the preparation became solid and the organic parts were carefully detached using blades then refrozen for an additional 24 hours in order to recover the molding obtained. The morphometry of the atrial appendage was thus studied according to imaging classifications [6] [7]. We were interested in variations in shape, main axes (apex-base of the orifice), angulations and trabeculae. The data obtained were analyzed statistically.

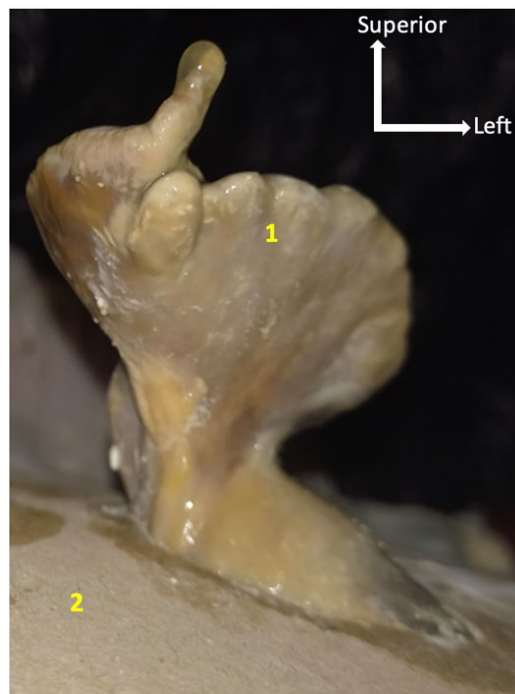


Figure 2. Shape of the left atrial appendage like a chicken wing after filling with semi-liquid plaster and 24 hours of freezing. 1- aluminum cardboard plate; 2- molded auricle first day.

3. Results

The sample consisted of 21 men (58.33%) and 15 women (41.67%). The average age was 33 years, with extremes of 24 and 76 years for a sex ratio of 1.4. The average weight of the hearts was 269.3 grams (± 39.52), with extremes of 212 and 360 grams.

The cauliflower shape is dominant with 57% of cases, followed by the chicken wing shape with 27%. The windsock and cactus shapes are less frequent, with 12% and 4% respectively.

The left pinky was often smaller than its right counterpart throughout the sample, the cauliflower shape was less bulky than the others. The smaller the left atrial appendage was, the closer its relationships were with the surrounding structures.

The cauliflower and windsock shapes have more lobes than the others (3). Concerning the axes, the cauliflower shape (**Figure 3**) presented a more marked

angulation depending on age and heart weight compared with a p-value of 0.87 while the cactus shapes (**Figure 4**) and sleeve air were direct or even semi-direct. Regarding the trabeculae, the cactus shape was followed by the cauliflower shape. The overall distribution of lobes, major axes and trabeculae according to the different shapes is summarized in **Table 1**.

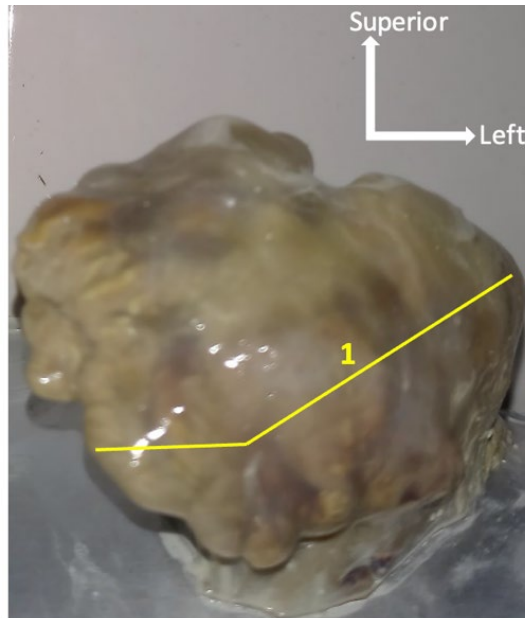


Figure 3. Cauliflower shape cast in plaster. 1- major angulated axis.

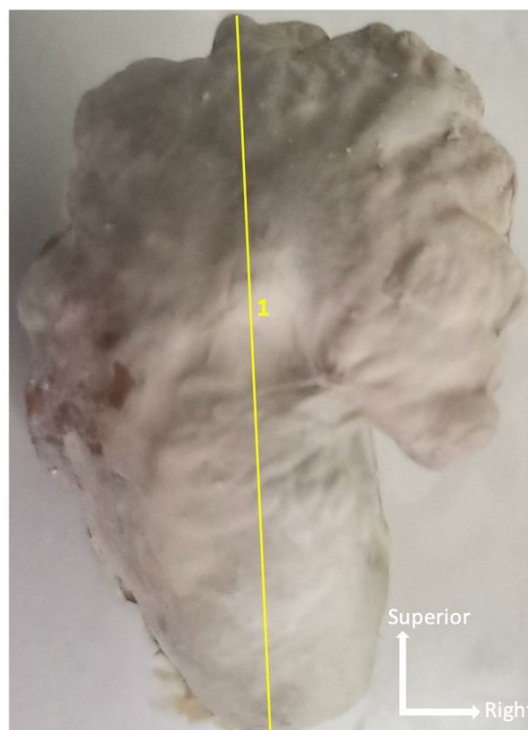


Figure 4. Cactus shape molded after 48 hours: direct long axis. 1- Major direct axis.

Table 1. The overall distribution of lobes, major axes, and trabeculae depends on the shape.

Shapes	Lobes	Major-axes	Trabeculae
Cauliflower	3	corner	11
Chicken wing	1	direct	4
Windsock	2	semi-direct	6
Cactus	1	direct	18

4. Discussion

In our study, the average age (33 years) was much lower than that of certain authors, such as Gunther *et al.*, whose results were around 72 years [10]-[12]. This could be explained by the fact that their populations were elderly people living with cardiac pathology. Concerning the morphological classification, studies on MRI scanners and mathematical algorithms of the left atrial appendage in 4 main shapes inspired us and demonstrated their inequality in terms of embolic risk [5] [7] [8] [10] [11]. Regarding the size and shape of the auricular appendage, we were in agreement with these authors, however our percentages differed a few times. The chicken wing shape (97.6%), largely in the majority compared to our results (27%). The latter would thus seem to pose little risk, with a rate of embolic events up to 8 times lower than with the form most at risk: cauliflower, less frequent in their series than in ours (57%) [8]. When the left atrial appendage is cauliflower-shaped, it has a high potential for dysfunction and contributes to the genesis of thrombus and an increased predisposition to emboligenic events of cardiac origin, such as atrial fibrillation with all cardio-embolic complications that this involves [8].

In our series, the cauliflower shape presented a significantly more marked angulation compared to the others without statistically significant differences depending on age and heart weight. GUNTHER [8] had the same results in addition to major spiral axes, for him, imaging techniques can frequently produce different images depending on the planes of space since 90% of his casts had four or more branches, caused by trabeculations of the appendicular wall. However, the distinction between trabeculations and thrombus poses a real problem of distinction in this *in vivo* reality, hence the interest of our study, which presents, in addition to the possibility of cleaning before molding, the reproduction of shapes, axes and trabeculae real.

Regarding the small size of the left atrial appendage compared to its right counterpart, our results were in agreement with certain authors [5] [6]. The latter also encountered lobes of no known use, variable main axes depending on the associated pathology and in relation to the adjacent cardiac and extracardiac structures. According to them, this relationship is extremely relevant for interventional procedures, especially since the apex of the appendix is more contractile [5] [6] [8]. They add that patients with atrial fibrillation, left ventricular hypertrophy, and myocardial scarring tend to have larger appendages, contrary to our findings

regarding weight. Knowledge of these facts would help interventionalists take advantage of imaging techniques when evaluating the adequacy of the left atrial appendage anatomy for closure to select the optimal device to reduce complications and increase success [6] [8] [10]. It will always require support on anatomical data to justify the interest in our study.

5. Conclusion

This work showed a great morphological variability of the left atrial appendage. It can provide an update on the specificity of Senegalese. Taking these variations into account is important in the management of hemodynamic conditions and the improvement of the management of recurrent strokes.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Rouviere, H. (1939) Précis d'anatomie et de dissection. 6ème Edition, Masson et Cie, 871 p.
- [2] Latrémouille, C. and Lintz, F. (2005) Anatomie du cœur. *EMC-Cardiologie-Angéiologie*, **2**, 231-251. <https://doi.org/10.1016/j.emcaa.2005.07.005>
- [3] Girod, G., Delabays, A., Monney, P., Pruvot, E., Eeckhout, E., Fromer, M., *et al.* (2013) Fermeture percutanée de l'auricule gauche: Un nouvel espoir pour le patient en fibrillation auriculaire? *Revue Médicale Suisse*, **9**, 332-336. <https://doi.org/10.53738/revmed.2013.9.372.0332>
- [4] Barbero, U. and Ho, S.Y. (2017) Anatomy of the Atria: A Road Map to the Left Atrial Appendage. *Herzschrittmachertherapie + Elektrophysiologie*, **28**, 347-354. <https://doi.org/10.1007/s00399-017-0535-x>
- [5] Wolf, P.A., Abbott, R.D. and Kannel, W.B. (1991) Atrial Fibrillation as an Independent Risk Factor for Stroke: The Framingham Study. *Stroke*, **22**, 983-988. <https://doi.org/10.1161/01.str.22.8.983>
- [6] Le Forestier, L. and Jaunet, C. (2020) Fermeture per cutanée de l'auricule gauche. Nouvelles Cliniques Nantaises, Nantes.
- [7] Nabeela, K. and Ho, S.Y. (2019) L'auricule gauche chez l'homme: Structure, physiologie et pathogenèse. ESC European Society of Cardiology Europepace.
- [8] Beigel, R. and Wunderlich, N.C. (2014) The Left Atrial Appendage: Anatomy, Function, and Non-Invasive Evaluation.
- [9] Di Biase, L., Santangeli, P., Anselmino, M., Mohanty, P., Salvetti, I., Gili, S., *et al.* (2012) Does the Left Atrial Appendage Morphology Correlate with the Risk of Stroke in Patients with Atrial Fibrillation? *Journal of the American College of Cardiology*, **60**, 531-538. <https://doi.org/10.1016/j.jacc.2012.04.032>
- [10] Khurram, I.M., Dewire, J., Mager, M., Maqbool, F., Zimmerman, S.L., Zipunnikov, V., *et al.* (2013) Relationship between Left Atrial Appendage Morphology and Stroke in Patients with Atrial Fibrillation. *Heart Rhythm*, **10**, 1843-1849. <https://doi.org/10.1016/j.hrthm.2013.09.065>
- [11] Antelmi, L., Ayache, N., Robert, P. and Lorenzi, M. (2019) Sparse Multi-Channel Variational Autoencoder for the Joint Analysis of Heterogeneous Data. *International*

Conference on Machine Learning, Long Beach, 9-15 June 2019, 302-311.

- [12] Gunther, E., Stollberger, C. and Abzieher, F. (1995) Morphology of the Left Atrial Appendage. *The Anatomical Record*, **242**, 553-561.