GROSS ANATOMICAL FEATURES OF LEFT ATRIAL APPENDAGE

G. Pardhi¹, S. S. Joshi², S. D. Joshi³

HOW TO CITE THIS ARTICLE:

ABSTRACT: Left auricle has unique developmental, anatomical and physiological properties. The Left Atrial Appendage (LAA) lies within the fixed, relatively immobile confines of pericardium. Although in the past it has been considered to be a relatively insignificant portion of cardiac anatomy, it assumes great applied significance as it is a common site of thrombus formation, its dislodgement and its sequel in thromboembolic phenomenon including strokes. The left Atrial Appendage can be evaluated by Trans-Esophageal-Echocardiography, MRI and color Doppler techniques. Not much literature is available on morphology of LAA including its shape, lobulation and size. In the present study average length of LAA was 4cm, and maximum width was 1.2cm. The shape varied considerably with various conceivable shapes possible. The inferior margin showed lobulations. In some cases a well defined pouch was seen. The apex of left auricle in majority of the cases was kinked and turned inferiorly. Apex may be bifid showing finger like processes.

KEY WORDS: Left atrial appendage, Morphology, Thromboembolism

INTRODUCTION: The Left Atrial Appendage (LAA) is characteristically small finger like extension from left atrium in human hearts. The LAA lies within the fixed, relatively immobile confines of pericardium. It has crenations over all lobes that are potential sites for disposition of thrombus.¹ In the past LAA has been considered to be relatively insignificant portion of cardiac anatomy, but it is now recognized that it is a structure with important pathological associations.² It is axiomatic that an understanding of the complex architecture of the atrial musculature should improve understanding of its activation and contraction.⁴ Use of Trans-Esophageal-Echocardiography has made clear imaging of LAA possible, so that its size, shape, flow pattern and content can be assessed in health and disease.² The LAA is a long, tubular, hook like structure which is usually crenated and has a narrow junction with the venous component of the atrium. In contrast, the right appendage is broad and triangular with a wide junction. Unlike on the right, the junction of the LAA with the atrium proper is not marked either externally or internally by a crest or groove.²,³

The Left Atrial Appendage (LAA) has developmental, ultra-structural and physiological characteristics distinct from the Left Atrium Proper.²,³ Owing to its tubular state its junction with left atrium is narrow and well defined.⁵ Thrombus has a predilection to form in the LAA in patients with atrial fibrillation, mitral valve disease, and other conditions. The pathogenesis has not been fully elucidated. The LAA shortens to a greater extent than the rest of the left atrium and has distinct pattern of contraction.² Knowledge of existence of multi lobed appendages are important in accurate Trans-Esophageal-Echocardiographic evaluation (TEE) of LAA.⁶

MATERIALS & METHODS: 32 hearts were taken from cadaver of approx. 60-70yrs age. LAA length and width were measured with the help of Digital Vernier Calipers and also with scale and thread (Fig No.4). Its various shapes and the position of the apex of LAA were noted. Presence of crenations, pouches and fissures were noted and photographed.
OBSERVATIONS:
- Shape of LAA is variable: it was irregularly ‘S’ shaped in the majority of cases, crumpled bag like, leaf like, or circular. (Fig No. 1a, b & c).
- Length of LAA is 4cm (1.1cm-7.5cm). (Fig No.4).
- Maximum width is 1.2cm (0.62cm-2.5cm). (Fig No.4).
- Apex of auricle was turned inferiorly in 87% of cases, superiorly in 10% cases and horizontally directed in 3% of cases. (Fig No. 2a, b & c).
- Inferior border is crenated in all cases (100%).
- Number of Notches on the inferior border varied from 1 to 2 and in some cases it was very deep. (Table 1)
- Number of pouches along the inferior border varied from 1 to 3, in some cases the pouches were very large (10%) (Fig No. 3a, b & c) (Table 1).

DISCUSSION:
The LAA is a small, muscular extension of the left atrium arising near the left pulmonary veins. It arise anterolaterally and lies at the left end of atroventricular sulcus atop the proximal portion of the left coronary artery and its branches. It has been described as a long, narrow, tubular, hook like appendage with a narrow junction with left atrium and crenated margin with large and small pouches.\(^3,6,7,8,9,10\)

The first detailed description of the varied morphology of the LAA was given by ERNST et al (1995) who studied the morphology of LAA using synthetic resins cast made at necropsy.\(^2\) Veinot et al (1997) carried out a quantitative study of LAA length, width and number of lobes. They stated that mean length and width increase with age up to age of 20yrs.\(^6\) But no previous study has reported the dimensions of LAA. In the present study, the length of LAA ranged from 1.1cm-7.5 cm and width ranging from 0.62cm-2.5cm.

Veinot et al (1997) stated that unlike the right atrial appendage, in which normal anatomy has been studied, the LAA has been relatively ignored except for general observations.\(^6\) In the present study, we observed various shapes of LAA as: irregularly ‘S’ shaped in the majority of cases, in some it was crumpled bag like, leaf like, or circular (Fig. No.1a, b & c).

Veinot et al (1997) establishes that the LAA has multiple pouches (80% have two or more pouches) and since these pouches often lie in different planes, use of biplane and multiplane Trans-Eosophageal-Echocardiographic (TEE) have allowed visualization of the LAA, which previously was difficult to visualize by other imaging methods. LAA is often suspected of harbouring the source of emboli material.\(^6,7,8,9,10\)

In present study we have observed presence of crenations along the inferior border in 100% of cases. Notches were also present along the inferior border in 50% of the cases: 1 notch-20%, 2 notch-10%, deep notch was present in 20% (Fig. 2c, 3a, b, c) (Table-1). We have observed the presence of pouches along the inferior border in all the cases examined: 1 pouch-70%, 2 pouches-20%, 3 pouches-10% (Fig.No.3a, b & c) (Table-1) whereas, Veinot et al (1997) have observed that 80% have two or more pouches.

The LAA shortens to a greater extent than the rest of the left atrium and has distinct pattern of contraction. Saady et al (1999) have stated that LAA is the site most commonly associated with thrombus formation particularly of Non Valvular Fibrillation.\(^2\) In our study we have observed that
apex of LAA was turned inferiorly in 87% of the cases, superiorly in 10% and horizontally directed in one case (3%) which has not been reported in the literature reviewed.

RESULTS & CONCLUSIONS: This study is an attempt to establish various dimensions of LAA. The shapes of LAA observed were irregularly 'S' shaped in the majority of cases, in some it was crumpled bag like, leaf like, or circular. Average length of LAA was 4 cm (1.1cm-7.5cm) and maximum width was 1.2 cm (0.62cm-2.5cm). Some of the LAA had multiple lobes & pouches which often were found to lie in different planes. We have observed crenations and pouches along the inferior border in all cases studied [1 pouch- 70%, 2 pouches-20%, and 3 pouches-10%]. Notches were observed in 50% of specimens [1 notch-20%, 2 notch-10%, and deep notches were present in 20%]. Apex of LAA in 87% was pointing inferiorly, in 10% of the cases superiorly, and in 3% it was directed horizontally.

All these morphological features of LAA impart irregularity to the lumen and can provoke the formation of thrombus and its dislodgement in the event, if there is any cause for stagnation (left atrial arrhythmia, mitral valve pathology, atrial fibrillation, transient ischemic attack).

The present findings will be of great help in the interpretation of Trans-Esophageal-Echocardiographic (TEE) and the understanding of the thrombo-embolic phenomenon.

REFERENCES:
10. Yoram Agmon, MD, Bijoy K. Khandheria, MD, Federico Gentile, MD, James B. Seward, MD (1999); Echocardiographic Assessment of the Left Atrial Appendage: Journal of the American College of Cardiology Vol. 34.

Table-1

<table>
<thead>
<tr>
<th>No. of Notches {inferior border} 50%</th>
<th>No. of Pouches {inferior border} 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 notch – 20%</td>
<td>1 pouch – 70%</td>
</tr>
<tr>
<td>2 notch – 10%</td>
<td>2 pouches – 20%</td>
</tr>
<tr>
<td>Deep notch – 20%</td>
<td>3 pouches – 10%</td>
</tr>
</tbody>
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Figure - 1

![Figure 1](image1.png)

**FIG: 1(A) Circular LAA**  **FIG: 1(B) Crumpled Bag Appearance**  **FIG: 1(C) Leaf Like Appearance**

Figure - 2

![Figure 2](image2.png)

**FIG: 2(A) Apex Turned Inferiorly**  **FIG: 2(B) Apex Turned Superiory**  **FIG: 2(C) Horizontal Apex**

Figure - 3
Figure - 4: To show Method of Measurement of Length & Breadth

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