Original article:

A Morphometric & Histological Study On Tendon of Infundibulum & Other Possible Connections Between Ascending Aorta and Pulmonary Trunk

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Abstract

Introduction: The tendon of infundibulum and its description is present in many medical textbooks and also in the mind of morphologists and surgeons.But some researchers unable to demonstrate the tendon of infundibulum in their study.

Methods: So, a descriptive observational study was conducted taking forty-four formalin fixed cadaveric specimens.All specimens will be dissected between the aortic and pulmonary roots, to detect the tendon of infundibulum or any other connection. Any measurement was taken by digital calipers.

Observations: Addional band like connections were observe in forty-two cases but no fascial band was found at the root of ascending aorta and pulmonary trunk. The Haematoxylin-Eosin &Van-Gieson'sstains revealed that the bands were made up of fatty & collagenous tissue.

Conclusion: Band like connections are primarily collagenousbut further studyis needed in future for detailed understanding of the nature of the band.

Key words: Tendon of Infundibulum, Haematoxylin-Eosin, Van-Gieson's Stains.

Introduction

Knowledge of normal cardiac anatomy is indispensable for the proper understanding of cardiac disease. However, many anatomical structures within the heart still remain inadequately investigated. One of these structures is the tendon of infundibulum.

There have been many references[1, 2, 3] revealing its presence and location between the aortic and pulmonary roots. Strangely enough, the presence or absence of such a tendon or ligament (conus tendon) has notbeen confirmed macroscopically andmicroscopically at the present time and furthermore proper function of such a tendon has not been yet established. Interestingly, many medical textbooks and atlases[1, 2, 3] still keep using such terminology but on the other hand the presence or absence of such a structure has never been mentioned in the context of surgical procedures taking place on the ventricular outflow tracts.

Moreover, some thread like connections has been described between ascending aorta and pulmonary trunkduring routine anatomical dissection. But surprisingly, no comprehensive study has been conducted so far in our country to establish the nature and distribution of such structures.

Aims & Objectives

The purpose of the present study, therefore, is to determine the existence and character of any

connection, corresponding to the literature, between the ascending aorta and pulmonary trunk.

Material& Methods

A descriptive observational study with cross sectional design of data collection was conducted in Calcutta National Medical College & Hospital over a period of six months. Only the undamaged formalin fixed hearts of either sex were selected for study. Persons died of any cardiovascular cause (Obtained from death certificates), any macroscopic pathological changes of the specimens of hearts and any visible injury of the specimens of hearts were excluded from the study.All the specimens will be prosected and fixed in 10% formalin solution.All specimens will be dissected between the aortic and pulmonary roots, to detect the tendon of infundibulum or any other connection. Special care will be taken during the dissection to visualize the space between the aortic and pulmonary roots from different planes. If any connection will be found the length and width of such connection was measured with the help of the digital calipers. The connections will be cut meticulously from both ends. Cases where tendon of infundibulum or any other connection were absent, tissues adjacent to the root of great vessels were collected. Both types of specimens were processed for histological examination and stained by haematoxylin-Eosin, Van-Gieson.

Observations &Results

Forty-four cadaveric hearts were dissected by following proper steps. No specific band like structure (Tendon of Infundibulum) was found at the root of the ascending aorta & pulmonary trunk in any case. But at higher level, separate band like connections were found between those great blood vessels in forty-two cases. In one case double band was also notedand the distance between those two bands was 3.11mm (Fig-1).Among the rest of the specimens, single prominent band was found in each case. The average value of length and width of such band along with age of the cadaver was depicted in Table-I.

Haematoxylin-Eosin and Van-Giesonstain revealed that the nature of the bands was mixture collagenous and fatty tissue (Fig-2,3). Tissue adjacent to the roots of the ascending aorta and pulmonary trunk was also processed and stained in a similar way where discrete collagenous and fatty tissue were found within the cardiac muscles (Fig-4,5).

Table-I: Mean with standard deviation along with range, mode, median values of different parameters of the present study.

Parameters	Mean	Standard Deviation	Range	Mode	Median
Age of the Cadaver(years) (n=44)	66.09	10.0460	45-84	67	67
Length of the bands(mm) (n=43)	19.23	4.1904	12.23-27.32	12.23	18.68
Width of the bands(mm) (n=43)	2.95	0.6109	1.92-4.21	2.82	2.87

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Fig-1: Double bands connecting Ascending Aorta & Pulmonary Trunk.

Fig-2: Dense connective tissue band. (Haematoxylin Eosin stain-10X)

Fig-3: Dense collagen band. (Van Gieson stain-10X)

Fig-4: Fibro-fatty connective tissue in between the cardiac muscle. (Haematoxylin Eosin stain-10X)

Fig-5: Fatty and collagenous tissue in between the cardiac muscle (Van Gieson stain-10X)

Details of abbreviations used in the photographs:

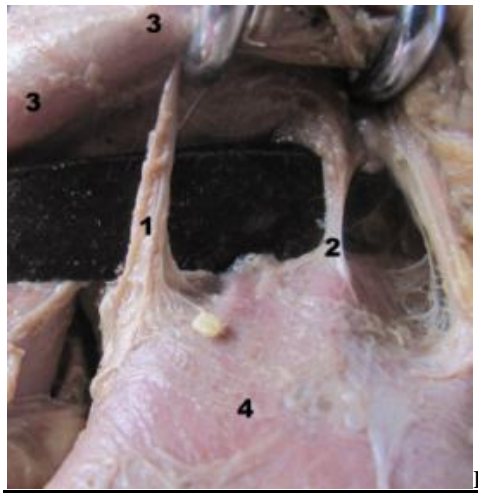

Fig-1:

1) First band
2) Second band
3) Ascending Aorta
4) Pulmonary Trunk

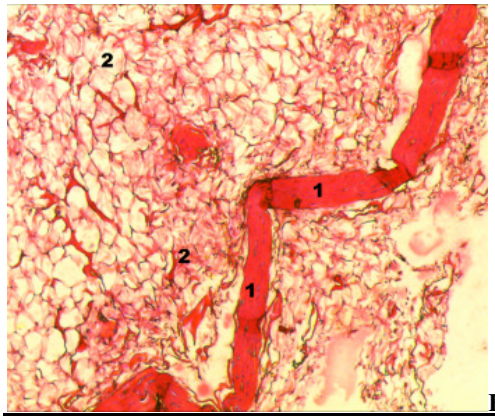

Fig-2:

1) Dense connective tissue band.
2) Fatty tissue surrounding the connective tissue band.

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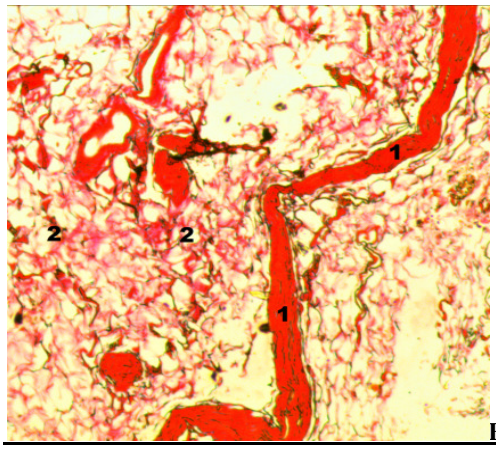

Fig-3:

1) Dense collagen band.
2) Fatty tissue surrounding the connective tissue band.

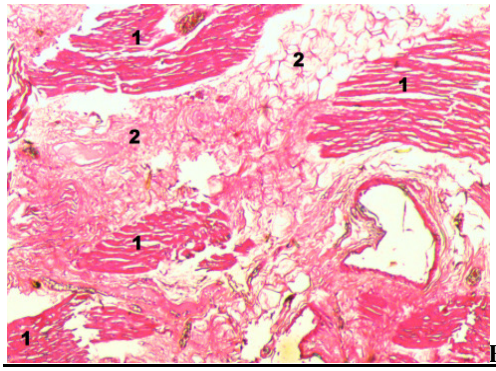

Fig-4:

1) Cardiac muscle.
2) Fibro-fatty Connective tissue in between the cardiac muscle.

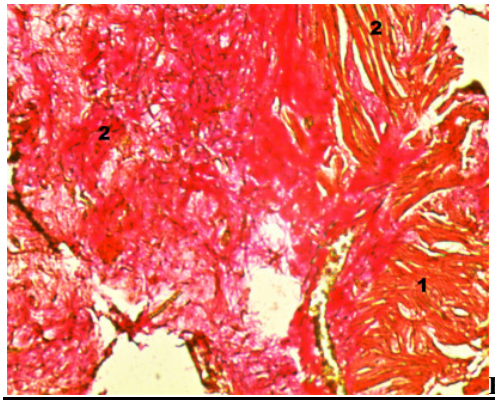

Fig-5:

1) Cardiac muscle.
2) Fatty and collagenous tissue in between the cardiac muscle.

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Discussion

Mall (1911)[4] was the first author to describe the tendon of infundibulum as a part of the fibrous skeleton of the heart. He described it as a structure occupying the region between the right side of the aorta, opposite the right coronary cusp of the aortic valve below the right coronary artery, and the facing wall of the pulmonary trunk. However, the tendon of infundibulum, even before, was variously termed the conus tendon of Krehl, as described by Mall[4]. Zimmerman and Bailey (1962)[5], in their paper of the surgical significance of the fibrous skeleton of the heart, said that the Ligamentum of Conus serves as a rope between the aortic and pulmonary roots, which permits a certain degree of torsional movement between them, while preventing them from being torn asunder by differentially directed ejaculatory forces of the ventricles. However, in their paper no macroscopic or histological picture was shown to prove their findings.

Walmsley and Watson (1978)[6] illustrated that the fibrous skeleton of the heart contains the conus ligament, a strip of tendinous-like fibrous tissue. Interestingly Gray's Anatomy[1] still retains two illustrations of the fibrous skeleton of the heart. McAlpine (1975)[7] was the first to describe that he was unable to demonstrate the tendon of infundibulum in his dissections, and he prefers to term a fascia, the connective tissue between the aortic and pulmonary roots. Furthermore, Lal et al. (1997)[8] were also unable to detect any fibrous structure connecting the aortic and pulmonary roots. However, they were able to identify only one specimen showing the so-called fascia or fascial bands. In addition, these fascial bands do not correspond to the initial description of the tendon of infundibulum and furthermore they cannot be defined as the tendon of infundibulum.

Conclusion

The present study supports the findings of McAlpine(1975)[7]& Lal et al.(1997)[8] and also provides information about the existence of band like connection between the two great vessels. These band like connections are primarily collagenous according to the present study but further studyis needed in future for detailed understanding of the nature of such band.

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