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A STUDY ON THE DEVELOPMENT OF A CARDIAC STRUCTURE OF THE BABY CHICKEN IN DEFFERENT PHASES

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Abstract:

Objective: *The objective of this study was to observe baby chicken cardiac structure in different developmental phases to serve in the initial normal stage.*

Place and Duration: *Services Hospital Lahore, Pakistan. From February, 2017 to February 2018.*

Methods: *Ninety healthy chicken eggs were classified in three various groups respectively Group I, II and III on the basis of their day of sacrifice. On seventh and tenth day of incubation we classified Group I & II correspondingly; whereas, on twenty-second-day Group III hatched which was also earlier.*

Results: *On seventh day all heart chamber formed including atrioventricular valves; Whereas, the shape of the semilunar valvular cusps was circular like Primordia. The staining of the elastic fibres was not possible in great vessels on seventh day contrary to tenth day. New hatched heart of the chick was semilunar valvular cusps which was slim and tinny.*

Conclusion: *Baby Chicken heart is good example to observe the properties of outer teratogens on cardiac development without any nurturing maternal hormonal stress and factors.*

Keywords: *Development, Cardiac Structure, Baby Chicken, Different Phases.*

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INTRODUCTION:

Cardiovascular system has great importance in Human anatomy consisting many important systems. Heart is one of the most sensitive and vulnerable point in the human body so its development has great concerns by the researchers. It is observed that cardiac morphogenesis growth of human heart is found similar to that of the growth of baby chicken heart [1]. Baby chicken embryo is one of the valued examples in experimental perspectives, for the studying angiogenesis in heart development and the growth in the neuro humoral cardiac systems. The baby embryo of the chicken was found developed outside of mother, and external stresses effects on the development of cardiovascular can be observed and studied without maternal hormonal interferences, hemodynamic or metabolic changes. Studying and observing the cardiovascular system is very clear and easy when we observe baby chicken embryo [2]. We also find there have been many advancements in experimental Management as well in the field of biotechnology. In this research of cardiovascular system, we find physical growth in different stages within initial stage.

METHODS:

This project was managed at Services Hospital Lahore Pakistan from Feb, 2017 to Feb, 2018. Ninety healthy eggs were selected as samples which were divided in three groups thirty each. Group one was sacrificed due to formation of muscular ventricular septum. Here the primitive ventricle is likely to get separate into right and left ventricles. Morphological development of heart is likely to be completed in near about 10 days. So, due to this Group 2 was cut apart at the day 10. At the day 22 Group 3 was cut apart. The rotten and old eggs were omitted from the study research. Observation was followed for the embryos till hatching day at the day 22. Humidity was kept (70% to 80 %) and incubator temperature was at (38.8 C). Embryos were drawn out by dissection at the day 7 and 10. Embryos were drawn out of albumen and yolk after the Chorioallantoic membrane and amnion were cut and the embryo was drawn out through cutting of yolk and albumen. By the day 22 some babies chicken got physically out and some babies chicken failed the process of their hatching.

After the day 7 and 10 at fixation of the embryos, heart was taken out along with great vessels this dissection was done before fixation. Fasciae (overlying skin) was removed, anterior thoracic wall was cut and heart along with great vessel were taken out. It was observed that Paraffin Embedding was initiated for the heart. We initiated our research study by taking out a serial section of (15 to 20 µm) thick from the frontal plane. For the Histological research study of cardiac tissue (6 µm) section was obtained from baby chicken heart. After staining with haematoxylin and eosin (6 µm) sections of baby chicken heart for histological study of cardiac tissue. Special staining elements were used to examine interlaced disc, Purkinje Fibres, Lipochrome Pigment and Collagen Content.

Intercalated disc was stained with the help of Iron Haematoxylin, for the assessment of Collagen Content, Mallory Trichrome and Sudan Black for Lipochrome was utilized for staining purpose. To know the presence of elastic fibres, Aldehyde fuchsin was utilized in pulmonary trunk and aorta.

RESULTS:

Aorta and pulmonary trunk were separated and the heart had Four chambers by the end of day (7). The four chambers are right atrium, left atrium, right ventricle and left ventricle.

Formation of valves of right and left atrioventricular (AV) took place and right AV with single cusp and right AV was bicuspid and the right cusp of left AV valve was larger in size then right cusp.

Left AV had Nuclei having various sizes and shapes as round, elongated, flattened and they were packed in mesh networked Fibrous Matrix Embryonal Mesenchyme.

Right AV had two kinds of tissue and valve was made up of Nuclei having various sizes and shapes as round, elongated, flattened and they were packed in mesh networked Fibrous Matrix Embryonal Mesenchyme.

Cell boundaries were not recognised in the circular shaped Nuclei in the valve continuous with the right ventricular wall. The valve was streamlined with Endothelial Cells (flattened in shape) on a side with ventricular trabeculations' endothelial management and on another side Atrial wall's Endothelial management. Semilunar Primordia were also visible in Aortic Vessel Lumen with their dense cusps within Circular form.

Whole Atrial wall had wave shape and on the other hand ventricle wall was smooth from outside and was thrown into trabeculations (on inner aspect).

Ventricular wall had two portions, outer compact and trabeculated inside. Compact zone was thinner in right ventricle than left ventricle while trabeculated portion was thicker than left ventricle. These two

portions had circular shaped Nuclei with unrecognized cell boundaries. Trabeculations were having blood cells in them.

Atrial walls had minor number of trabeculations and thinner walls than ventriculi's extended and slim walls. Pulmonary trunk and Aorta were formed up by tissues. There were found blood cells in vessels. Oval Nuclei were found in Ad luminal vessels walls and this covering was thinner than outer covering having many coverings of compressed Nuclei in the Lumen in concentric form.

Tissues of day (7 and 10) making connections with each other were compared containing Fibro Fatty with arterioles, venules and capillaries. There are different Nuclei in dense mesh network of Eosinophilic matrix in fibre shape in the middle layer and flattened Nuclei in innermost layer. Semilunar valvular cusps were more thin and slim as that of time in Embryonic stage.

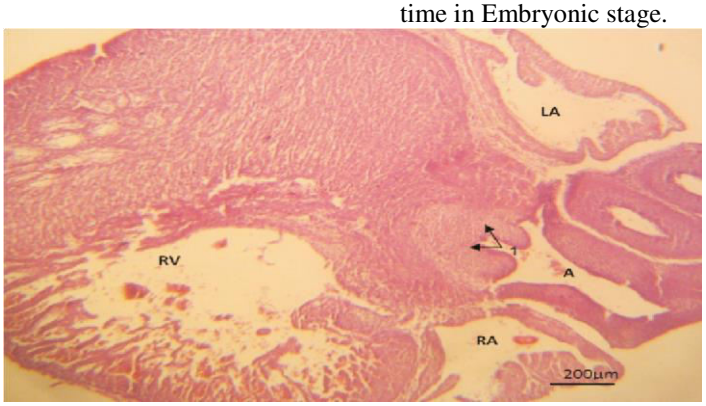

Figure - I: Day 7 control chick heart showing round cusps of semilunar valve in aortic lumen (1), Aorta (A), Right atrium (RA), Left atrium (LA) and right ventricle (RV). Specimen no. A1 (163'). Haematoxylin & Eosin staining

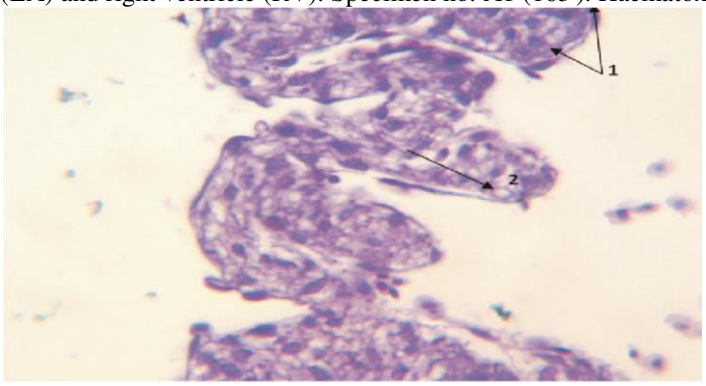

Figure - II: Atrial wall showing trabeculations in a day 7 chick heart. Flattened endothelial cells (1) lining trabeculations. Round to oval nuclei (2) within the atrial wall. Haematoxylin & Eosin staining.

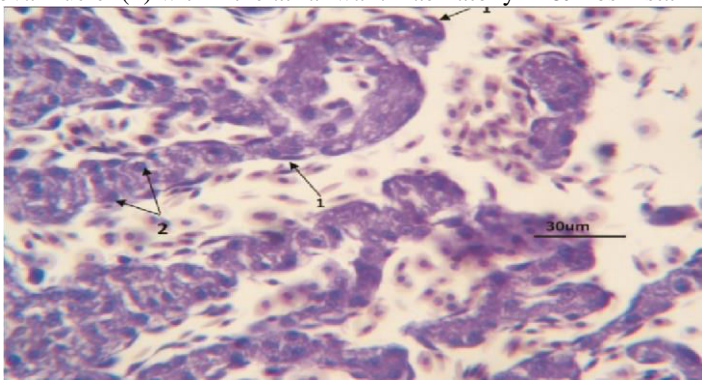

Figure - III: Ventricular wall of day 7 chick heart thrown into long and slender trabeculations. Flattened endothelial cells (1) lining ventricular trabeculations and round nuclei (2) of ventricular wall Haematoxylin & Eosin staining.

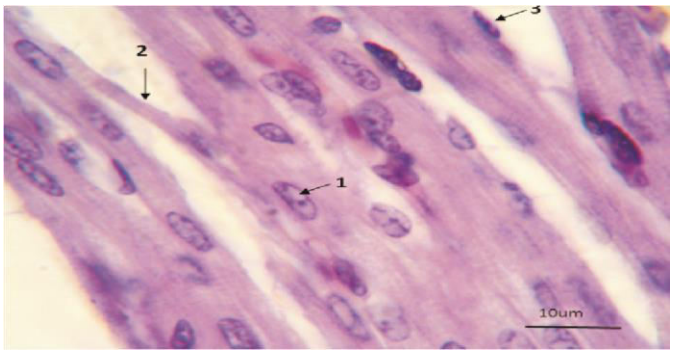

Figure - IV: Newly hatched control chick heart showing cardiomyocyte with cylindrical nucleus (1), branching of cardiomyocyte (2), flattened nucleus of intramyocardial fibroblast (3). Haematoxylin and Eosin staining.

Figure - V: Newly hatched control chick heart showing slender semilunar cusps in the aortic lumen, aorta (A). Hematoxylin & Eosin staining

DISCUSSION:

At the present day as 04 chambers including left and right Atrium; and left and right Ventricle Aorta & Pulmonary trunk got separated on the seventh day. It was found that discharge of tract station widespread between the day (7 and 85) [3]. At the day 7 left and right Atrioventricular valves had been developed by day (7). It was found that at the day 6 Atrioventricular valve Primordia were developed and their further development sustained with development [4]. Formation of semilunar valvular promotional material development started by the day 6 and ended on the day 7 [5]. In great vessels the dense lamella was stained on 10^{th} day in baby chicken hearts and in newly baby chicken hearts but not in the hearts as on the day 7 [6]. Elastic Fibres were found similar in hatched baby chicken heart as in previous research in which elastic fibres were found after staining with Orcein-van Gibson in baby chicken heart but the ventricular layer wall at outside portion had more density due to trabeculations, due to which the layer of trabeculated from inner side became thinner [6]. The wall of left Ventricular had thinner layer than that of right Ventricular having slim and low number of trabeculations and denser compact coating [7]. Head-to-head trabeculations were already combined forming up interventricular septum. Atrial trabeculations formed up in less frequent and dense state. The wall of left Atrial had also less frequent trabeculations than compared to the wall of right Atrial [8].

It was revealed through Histological fragments of hatched baby chicken heart; cardiac muscles fibres were the main element in composition of Atrial and Ventricle walls. Horizontal cardiac fibres lengthened to oval fade staining Nuclei with dark granular staining consisting material of Chromatin.

Fibroblast was lined up with peripheral fibres with Nucleus [9]. In fibres (longitudinal) the network of Cardiac fibres was found. Intercalated disc was not found. There were Nuclei in some fragments in round shaped fibres and some fibres were found empty. Right Ventricle wall was denser than that of left Ventricle. There was formation of Mesothelial flattened cells with sub epicardial fibro fatty (attachments tissues) on lower side and having capillaries and venules. There were three layers in Pulmonary Trunk and Aorta and the outer most was unfastened [10]. In another research the elastic fibres at the day 10 were also found embedded with Paraffin tissues in which staining element was Haematoxylin-eosin and this research was aimed to find out the skeleton of wall of Aortic [11].

At the day 10 Resorcin-fuchin as special staining element were applied highlighting elastic fibres. Established elastic microfibers are formed up of micro fibrils and shapeless elastin structures. By the day 03 elastic fibre started developing but there was no elastin structure formed at that time. In the baby chicken embryo weak staining of elastic fibres at the day (7) can be due to Incomplete development of established elastic fibres containing Micro fibrils and elastin bundles [12].

On the day 8 and 20 of incubation it was found that the processes related to elastogenetic started in baby chicken Aorta. It was found that the process of elastogenesis during the day 8 and 10 of incubation with the help of electron microscope, small but identifiable elastic fibres were found and this highlights that before this stage elastic fibre were under development stage and were not evident. When Orcein was used as staining element at the day 5 to stain plastic fibres in the development stage in which newly under developing elastic fibres were emerging but these were not established enough at the day 7 as to be completely stained [13].

Comprising over outer compact and inner trabeculated portions the walls of ventricular looked trabeculated. Finger like structure of trabeculations was obvious. In previous studies Myocardial organization was also observed. In ventricles further in luminal layers, appearance of trabeculations was a function which cause increase in the mass of Myocardium without presence of any discrete coronary circulation [14]. The trabecular layer transformed consolidated state in its deeper part in the upcoming growth and it enhanced the compact element of ventricular myocardium and the other part of layer attached with ventricular lumen sustained its trabeculations. On initial stage compact layer had few number of cells were dense but as the time passed there formed up a multi-layered structure with trabeculations with the endothelial cells were arranged [15].

With each minor trabeculations the walls of ventricular were present in thicker form than Atrial walls and long and slender ventricular trabeculations were bigger than Atrial trabeculations that were in round shape arranged at the day 7. It was observed in former research that at the day 5 Atrial trabeculations happened and these were believed causing addition and enlargement in the atrial contractility is considered as pectinate “muscles” by which atrial lumen can possibly be traverse. Along with the great vessels of Primordium and valves of interventricular Septa, all the four chambers are designed and developed [16].

It is obvious by the day seven that complete elastic fibres were not developed and by tenth day and on hatching there was a visibility of elastic fibres that can also be stained in a better way. Comprising over Mesenchymal cells and chambers cardiac walls are made by the day 7 and the day 10 and these were comprising over red blood cells (RBC Nucleated) as well as Progenitors blood cell which were large in number, nucleated and circular. When chicks were hatched, complete cardio myocytes were visible in histological fragments sections arranged with compressed fibroblasts.

CONCLUSION:

Baby Chicken heart is good example to observe the properties of outer teratogens on cardiac development without any nurturing maternal hormonal stress and factors.

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